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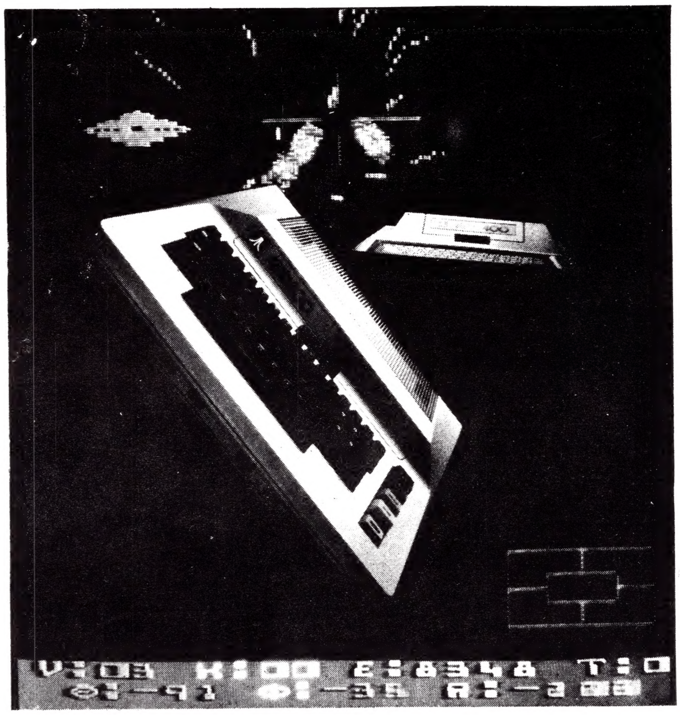

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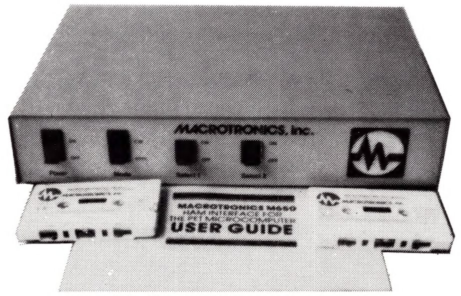

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NEWSPRINT

Miriam Cosic and associates present the latest world-wide micro news.

Delayed atomic reaction

The British have many talents. They've given us some wonderful things — the Queen Mum, the plum pud, the stiff upper lip, and some eccentrics might even include cricket. But, of course, the talent they're most famous for is administrative efficiency. Ask the Indians. After a couple of centuries of squatting in India they left the country in a socio-economic mess — but they also left a superbly efficient civil service structure. However, as they've lost their empire so they seem to have lost the knack of overseas organisation and communication.

All this is by way of introducing the fact that the Acorn Atom is finally here. I held over writing about it till last August, the first final delivery date. My article and the prospective retail company both went into the wastepaper basket when it didn't materialise. At that time, the company's owner and I had conflicting information about what the thing could actually do.

Recently, one of the partners of Consolidated Marketing, sole Australian distributors for the Atom, flew to England. Perhaps he pointed out that he was living proof that, in these technologically advanced days, something could be in one country one day and in another not very long after. The Acorn Atom is here now, and is selling for around $830 plus tax.

It is a single board micro and is designed around expandability. The memory goes up to 48k RAM, in cluding external memory, and the ROM to 16k. It outputs to a domestic TV set. A PAL encoder module will be available to provide colour, though a lot of judicious fiddling by anyone who thinks s/he has some grasp of electronics will produce a direct connection to a colour monitor.

The Atom Basic has the unique feature of including an assembler in the interpreter. Data supplied includes standard 6502 mnemonics: and when the interpreter finds and recognises this data, it actually runs it, rather than calculating output from it. This is supposed to make it three to five times faster than Apple Integer Basic.

Teachers would be interested in the networking system — brought about by means of a cunning Motorola Device MC68A45, ADLC or Advanced Data Link Controller. A daring innovation, each Atom can have a wired receiver/transmitter with its own station code; and any Atom can transmit the station code of any other Atom in the circle of connected computers and the ADLCs of all the remaining machines immediately set themselves to a 'do not transmit' position until those two have finished talking. The conversation runs at 9600 baud. My British connection said (several months ago now) that the Acorn people see this as a classroom technique first, where the teacher can take over any of the pupils' machines, see what's going on and then print messages on the student's screen.

Consolidated Marketing Corporation is at 308-312 High Street, Kew, Vic. 3101; Tel: (03) 861 5063.

A Royal service

Over the past seven or eight months, Royal Micro Systems have been building up a fast test-and-repair service for printed circuit boards. They also manufacture testing fixtures.

The equipment handles incircuit testing of analogue and digital components by electronically isolating each one, as well as providing functional testing of the PCB as a whole.

The whole process is claimed to take only a matter of seconds, once the program has been established. The program charge is $20 but, in case hobbyists think this service might be for them, the charge for actually testing a complex circuit board is around $2500. So its a back up system for the larger computers, as well as word processors, cash registers and such, for which it works out to be a cost effective enterprise.

Slavery reclaimed

MicroPro Design have released another interface for use with their all-Australian MicroCon microprocessor system. The IEEE488 (HPIB) bus allows the Microcon to act as a slave to computer systems, in such a way that the microprocessor in the MicroCon can control and monitor systems using other interfaces.

The microprocessor in the MicroCon can have its program loaded from the host computer, allowing it to perform the control or data acquisition function independently of the operation being performed in the host, which is great for real-time applications.

MicroPro Design Pty.Ltd.,
P.O. Box 153, North Sydney,
NSW.2060.Tel:(02)438 1220.

Superlative language

RTL/2 is a high level language which is said to have significant practical and cost advantages over more conventional languages in real-time application. Time really will tell.

Dr. Goorevich, of IP Computer Consulting Australia which is now marketing and supporting the lingo, says that it is widely recognised as the most suitable language for developing real-time systems in Europe, where it has been in use since the early 70s. He says it's very well-defined, and features multi-tasking, reliability, efficiency, flexibility, ease of use and portability. . .

I can't see why I haven't heard of it before. Contact the company on (02) 411 3522 in Sydney; or (03) 690 2300 in Melbourne.

More cottages

Cottage Computers is not defunct, merely withdrawn. They still have the CRT—1000 Video Display card for DIY Terminals. Drop a line to P.O. Box 27, Clifton Hill, 3068, or ring (03) 481 1975.

Biggies grow up

The first sign of the future, the first indication that 16-bit 'big micros' are coming must be the announcement of a version of CP/M for the Intel 8086 micro.

At the moment there aren't a whole lot of 8086 systems around. The very first was the British Elite system from Modular Business Systems in England. Since then, there have been a few others, mainly from people like Burroughs, and IBM. (Yes, IBM. Its latest word processor, the Displaywriter turns out to be an Intel 8086 with floppy disks. Only one snag: IBM won't let your nasty little fingers in to program the machine. And it does have a lovely spelling program, which shows you which words have been spelled wrongly.)

Digital Research produced CP/M before the 8080 and Z80 micros had become as popular with micro users as they are now. In fact a major cause of that popularity was CP/M. If Digital Research can do it again then we can expect good things of the 8086 and any other micros that run the same programs. At the moment, that is none; put your money on imitations for the future, however.

In the lab

The criticism levelled at the TRS-80 and the feeling in some quarters that such toys should not be allowed to taint a scientific environment did not seem to herald an auspicious future for these machines in the scientific laboratory. The situation was not helped by the suspicion that the main reason their junior personnel requested such things was to play 'Star Trek' during tea breaks — and beyond.

Despite such obstacles, however, the TRS-80 and similar machines have now found a place in the scientific laboratory and are increasingly mentioned in research papers. Research into certain aspects of nuclear magnetic resonance spectroscopy being carried out by L.E. Erickson of the National Research Council in Ottawa requires a magnetic field of specific strength and a direction. Such a field can be provided by using three pairs of coils mutually at right angles and a recent paper describes the use of a Commodore PET to control the set up. After the field strength and direction required have been input by the experimenter, the PET performs the necessary mathematical transformations and uses the data to control the power supplies of the three pairs of coils. A feature of the program is that it compensates automatically for the Earth's magnetic field.

The interface uses 12-bit digital to analogue converters and data is transferred to the power supply interface by a 20-byte serial, bit parallel transfer. Odd-numbered bytes are for synchronisation of the transfer and even-numbered bytes are composits of address and data. The program is written in Basic and the entire transfer takes 0.3 seconds. The author notes that this would be much faster if machine language programming were used to control the timing.

Geoff Turner

There are still a few businesses too small for a small business computer...

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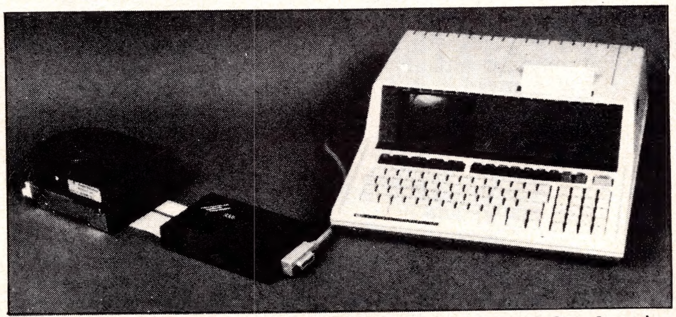

The MSC mini-Winnie controller (centre). See 'Disk hook-up'.

Disk hook-up

Elsewhere on this page you'll find a photo of a computer joined to a little black box joined to a mini-Winnie hard disk. The black box (why are they always black?) is a low-cost ($700) controller, which could give your PET a vast storage capacity.

Two intriguing things are not said in the large amount of information provided by the supplier, Microcomputer Systems Corporation. The first is: why show the controller being driven by the Hewlett-Packard HP-85 and not the PET? And secondly, what is the supplier going to do with it?

The magic part of this little black box is the fact that it uses an HP-patented method of connecting a computer to a device — the general purpose interface bus (GP-IB) — which also occurs (with minor variations) in the PET. In fact, the PET had it first — the HP-85 didn't get its own GP-IB until a couple of months ago.

The minor differences between the full GP-IB, as specified under the IEEE and IEC as the 488 standard, and the PET interface, should not affect this device. A disk drive doesn't have subsidiary devices to control, and it is only in the area of subsidiary devices that the PET can need watching. So it's a safe bet that PET will drive the disk (a Shugart ST-506 drive) with this interface. So why didn't Microcomputer Systems say so? Intriguing.

Secondly, the question of why. Microcomputer Systems specialises in hardware interfaces, but is believed to have an interest in promoting products which it knows will be in high demand. Sources in California say that the choice of this drive is linked to Hewlett-Packard's plans to launch a database manager — software for controlling and searching through large volumes of stored data files — soon.

Incidentally, the controller can be used with PET — and, "with a minimum of cost and design effort," with Apple, Prolog and systems using Intel's Multibus. But on the face of it, stay with PET and HP systems until we know just how 'minimum' this effort is.

Guy Kewney

A handy cap for the year

This is the International Year of the Handicapped and we in the computer industry are strategically placed to make it worthwhile. Medical technology has extended the life expectancy of mentally and physically handicapped people, often up to the average span. Computer technology has revolutionised both the medical and non-medical aspects of the individuals interaction with his/her environment.

In terms of medical applications, the ramifications for the handicapped are exciting and awe-inspiring. Dr. Mc Leod, of ANU, is working on an idea he brought back from Michigan State University for teaching the blind to write using computer-based information about letter formation and pen movement, a digitised pen, a voice synthesiser for performance feedback, and a sensitised wrist cuff. In the United States (where handicapped people form a bigger group in absolute terms, have greater political clout and therefore can better affect funding policies) research is moving into almost science fiction regions such as the implanting of chips to artificially stimulate and coordinate the muscles required for walking, or to bypass the retina and interpret miniscule video receivers. The bionic man may be truly at hand.

In non-medical terms, computers make productive work and even handling the most routine household tasks much easier. Centre Industries, at a spastic centre in NSW, is a data processing bureau. It uses a Honeywell GE58 and employs two programmers, two operators and fourteen keypunch staff — all handicapped. A quadraplegic, living in rural Victoria, uses an Apple to run a stud accounting business servicing local farmers. Another, living in the same state, has his whole house wired up to a Tandy.

For those of us who are handicapped, no International Year is necessary to exhort a greater awareness of the needs of this section of the community. For those of us whose bodies are more or less intact, we should not be too blase — just a fraction of a second brings an accident situation which could result in some form of incapacitation.

An awareness of this year's theme could inspire a worthwhile project for a hobby computer, or give you a wider potential pool for staff selection, or even lead to a brainwave while renovating a Star Wars program or working on a maths class problem. To rehash the old saying, " the life you improve may be your own".

Software show

An exhibition which it is hoped will stimulate an awareness of the importance of software in all areas of computer use and provide an intro to what some are calling the "software decade" is scheduled for February.

The Software Showcase will be held in the Lower Sydney Town Hall from the 17th to the 21st.

Cobol for Apples

The fact that a company like Micro Focus has produced a Cobol compiler for the Apple II is not an invitation to its 150,000-odd owners to learn how to write programs in Cobol. It is a concession to reality.

Reality is the fact that Cobol is an old language, not very good at performing the tasks that today's micros are best at. It is at least as awful (in purist terms) as the Basic all we micro owners use and five times as hard to find faults in programs written in it, and ten times as hard to correct them. Okay, so that's just opinion — but it's a common one.

The reason it is important is simple: most of the world's professional full-time software writers know how to write in Cobol and in nothing else.

Their employers, seeing 150,000 Apples rolling around, would like to start producing programs to run on them — and all their current programs are written in Cobol.

Micro Focus produced the first Cobol compiler for the Intel 8080 some time ago but that micro is not the chip inside the Apple. To get the Micro Focus onto the Apple, they had to wait for Microsoft, who launched a little plug-in-unit called the Z80 softcard, which actually puts a new microprocessor into the Apple — a micro on which Micro Focus's Cobol will run. So, for that matter, will Microsoft's Cobol — but the word so far is that Micro Focus (a British company) has a rather better Cobol than Microsoft's. Talk to Micro Focus in London on 722 8843.

Guy Kewney

More for schools

Another company trying to capture the education market is Microprocessor Applications. Their Micromation computer system is a single-board computer with 64k RAM, built around the S100 bus. Upgradable to a multi-user system by simply plugging in more boards, each user is allocated an individual CPU and the full 64k, and there is no memory sharing, time penalty or program running restrictions. A mark sense card reader is currently being developed. Tel: (03) 754 5108.

Self-defeating sexism

I was taught never to read other people's mail, so when I received a press release the other day headed "Gentlemen. . . ", I read no further. What's more the envelope was addressed to our advertising manager who is also a woman. Sirs, I should rethink your publicity methods, if I were you.

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AUSTRALIAN MICROCOMPUTER HANDBOOK

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Chapter 5 outlines the capabilities found in BASIC – the most popular of all microcomputer languages. Chapter 6 provides guidelines for selecting microcomputers, particularly for those people contemplating commercial applications. Chapter 7 looks at the capability of microcomputers in word processing and is also a useful introduction to word processing in general. Chapter 8 projects the future potential of microcomputers in the coming years, while Chapter 9 looks at the future trends in microprocessing and microcomputing design, as outlined by a leading semiconductor manufacturer.

Chapter 10 discusses the use of microcomputers in communications and networking applications and is also a useful introduction to the general area of communications and distributed data processing. Chapter 11 traces the history of the S-100 Bus and outlines the different bus signals that have nowadays become fairly standardised.

PART II provides a 2 to 6 page summary on the range of microcomputer and desktop computers sold in Australia including the following:

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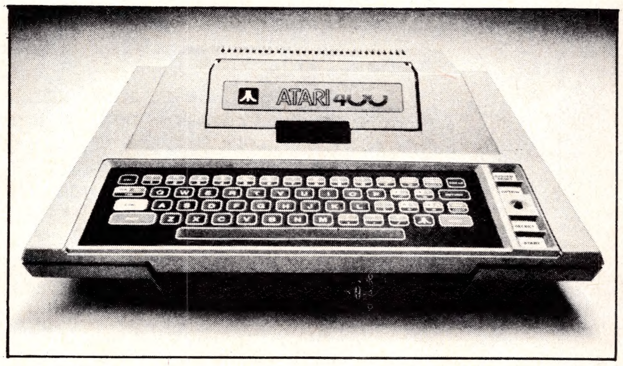
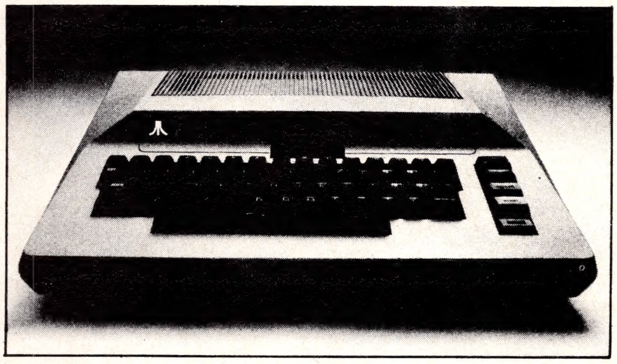




Once again APC brings you an exclusive Benchtest – this time it's of two exciting computers to be launched in the middle of this year. By offering TV games and audio-visual education capabilities as well as normal computing, Atari says it has created the first machine to be aimed at the true home market. The easy-to-use computers plug into the domestic TV and through it provide a wide range of graphics, colours and sounds; David Tebbutt reports.

Atari claims its 400 and 800 series computers are the first of a new generation of home/personal computers. They are primarily aimed at the home user who will be able to play pre-packaged games, learn all manner of things with audio-visual educational packages, sort out his finances or simply compute. No doubt people running small businesses will be interested in this machine and many of them will find it suitable but at the moment it does have some limitations — all Atari printers use paper rolls as opposed to sprocket fed fanfold paper and few business packages are available. It's quite possible that this will change so don't rule it out completely.

We've all been scratching around for years now wondering if and when the home market will ever exist — I think that Atari will create the market with the home education packages on this machine. One thing is very clear — as the rate of change in our society increases, so we shall have to learn new skills to cope with this change. It is well known that enjoyment goes hand-in-hand with learning — people learn more when they're having fun — so Atari has quite sensibly latched on to this and, bearing in mind the social climate, sees its educational packages being used by children and adults alike. The consumer education market is a big one; the Atari machine is well suited to it and it has the potential to do extremely well.

Both machines are well made and look quite pretty — a glance at this month's cover will tell you far more than any words I write. The 400 differs from the 800 in that it has a flat touch-sensitive keyboard and limited expansion capabilities. It is capable of doing everything that an 800 of the same memory size can do and anyone buying a 400 and then wishing to upgrade to an 800 will be able to run all their existing programs on their new computer.

Both machines plug into the domestic TV (colour or black and white) and are very easy to use. Programs can be loaded from a cassette recorder (Atari), disk or they can be run from a plug-in cartridge. It's interesting to note that the cassette recorder is used for audio as well as digital information which means that the audio channel can be played back through the television speaker under program control — no doubt this feature forms the basis of the audio-visual packages mentioned earlier. The 800 contains a socket for a video cassette recorder — imagine the potential for this machine when video disks come along — it will be possible to access about 12,500 Mbytes of digital information on just one such disk.

Other peripherals available are disk drives, printers, an RS232 interface — necessary for talking to non-Atari devices (other printers perhaps) — games paddles (three types) and a light pen. Given the right marketing, the right price and right level of support Atari could do very well.

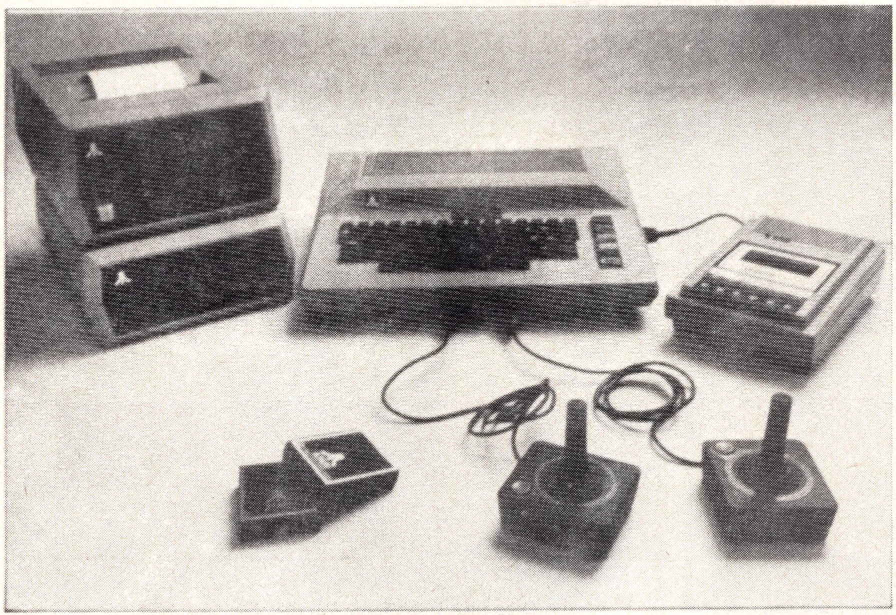
Hardware

I was supplied with a 16k model 400, a 48k model 800, a 90k single disk drive, a 40-column impact printer, two joystick controllers, a cassette recorder and a selection of disks and cartridges.

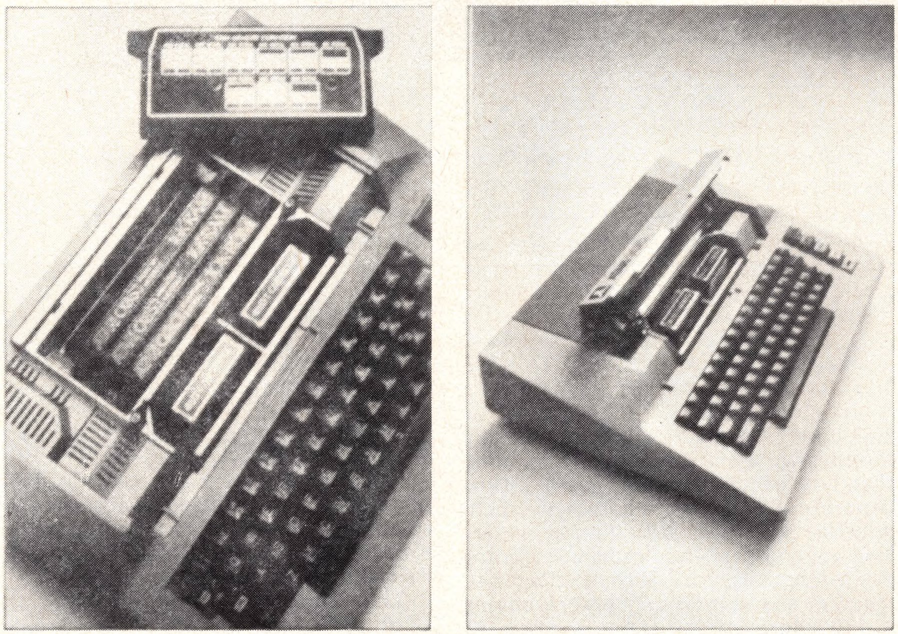
The model 400 measures 13½" x 11½" x 4½" and weights 5¾ lbs. It has a flat keypad with each 'key' having raised edges, which makes for a much better feel than the more common totally flat keyboards. Having spent a week switching backwards and forwards between this and a conventional keyboard with real keys I definitely prefer the latter. In theory the 400 should only be connected to a printer and a cassette recorder but, in view of my cassette problems, I hooked up a disk drive and it worked. The disk operating system gobbled up rather a lot of memory with the result that I was left with just 4238 bytes for program storage. It is possible to reduce the DOS requirement by about 5 kbytes leaving just the bare minimum of routines to keep the disks running. Really, the 400 isn't a disk machine but you could probably get away with it — just.

Finally the 400 has one slot for exchangeable cartridges. I was supplied with a Basic cartridge and three games: Basketball, Star Raiders and Alien Invaders. It was very tempting to spend the week playing Star Raiders rather than preparing this review.

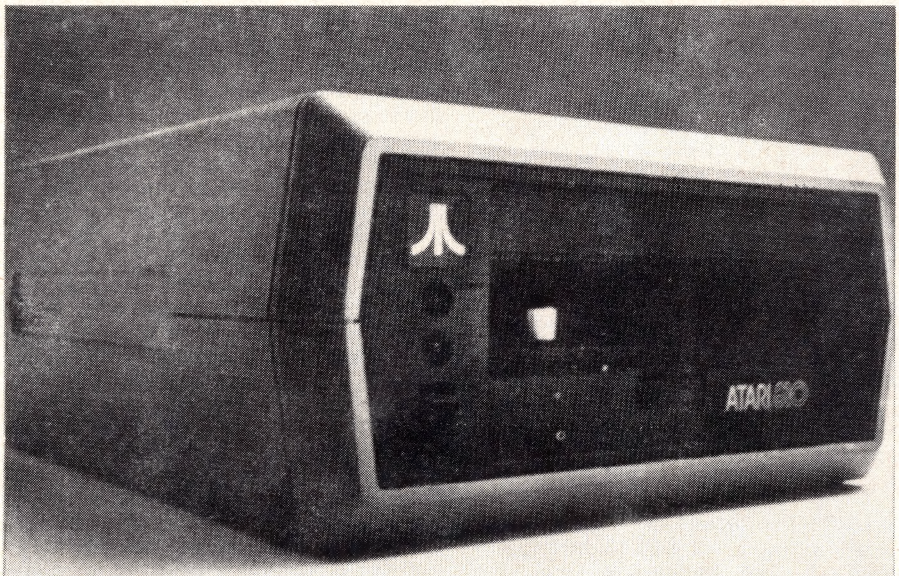
The 800 is clearly a more grown-up machine. It has a normal keyboard which came as a great relief after stubbing my



A useful configuration comprising an Atari 800 with disk drive, forty column printer, cassette recorder and a couple of joysticks.



Two views of the 800 showing the locations of the various plug in modules.



A close up of the 90k disk drive.

fingers on the 400 for a few days. The reset button is protected by a plastic surround which stops you pressing it inadvertently. For those buying a 400, don't worry — the reset doesn't clear your program. Two cartridge slots are provided: the left one is the equivalent of the one in the 400 while the other's a bit of a mystery. Somebody did mutter something about bubble memory but I think it was speculation rather than a fact. It seems to me that some cartridge programs will exceed the 8k limit and the second slot will enable them to overflow. The 800 has a DIN socket for connecting a VCR or an external monitor — see my earlier notes about video disks.

The 800 can be expanded using either 8k or 16k expansion memory modules. (Rumour has it that the 8k will be dropped and that a 32k is on its way.) Three slots are available giving a maximum of 48k if you use 16k modules. A fourth slot contains the 10k operating system. The fact that this occupies a plug-in slot must mean that the operating system can be easily upgraded. All these modules may be installed by the home user in about 30 seconds flat.

The cartridge slots occupy memory locations from 32k to 48k so if you have a 48k system you will lose 8k if slot A is in use and 16k if both are being used.

Like the 400 the 800 is compact measuring 16" x 12½" x 4½" and it weighs in at 9¾ lbs.

I have now covered all the main differences and the rest of the review relates to both machines. For convenience I shall call the machine the Atari.

The keyboard is arranged in the standard qwerty format with the addition of a number of control and special function keys. Each key may be used in three or four different modes: control, upper case, lower case and graphic character. With 57 keys this means that over 170 different characters can be generated. In addition to this, each character may be displayed in normal or inverse video giving a true range of over 340 choices. Each time a key is pressed the keyboard (not the television) 'peeps', very useful on the 400 when you can't always be sure you've made contact.

Cursor movement is as flexible as you're likely to need with up, down, left, right, clear screen and tab controls provided. It is possible to set and unset tabs anywhere along a single line on the screen. The manual suggested that tabs could be set anywhere in a logical line (up to 120 characters); if it's true I'd like someone to explain how. All keys repeat after they have been held down for about a second, which is especially useful when screen editing. All character modes — upper case, lower case, inverse video and graphics — may be 'locked' until changed. When the machine is in lower case mode, upper case characters can still be obtained by pressing the shift key just like a normal typewriter.

The screen format can be any resolution from 12 x 20 to 320 x 192 with up to five colours. In normal text mode it is 24 lines of 38 characters although the line may be altered to any length between one and 40 columns. A logical line is three times the physical line length and when nearing the end of a logical line the keyboard 'peeps' a warning. Character insertion and deletion is provided as well as line insertion and deletion. Line delete removes a whole logical line from the display but not from memory (if you're keying a program) whereas line insert makes space for a single physical line.

Four remaining keys on the right of the keyboard allow for system reset, select, option and start. Apart from reset these keys relate to the selection and initiation of functions in a cartridge.

The processor used is the 6502, the same as that in the PET, Apple and others. It runs at 1.8 MHz and gives benchmark timings which are a little slower than PET or Apple. The real time clock runs at 50 Hz, unlike the American version which runs at 60Hz so some US packages will run a little slow here.

Four ports are provided at the front of the machine for attaching controllers — either knobs, joysticks or keypads. Up to eight controller knobs may be attached (in pairs) each returning a value from one to 228 depending on the knob's position. The joystick is a nine-position controller and up to four may be attached. As well as the positional controls, each device contains a trigger button. Up to four keypads may be attached, each containing keys 0 to 9, * and #.

One input/output port is provided on the side of the machine. Each device which can be attached has two sockets to enable others to be 'daisy chained'. The printer, disk drives, cassette recorder and RS232C expansion unit may all be connected in this fashion. A light pen plugs into one of the front controller ports.

The cassette recorder can be used with any high quality audio tape and reads from two channels — one audio, the other digital. It transfers digital information at 600 baud and is very sensitive to speed fluctuations. Sound is output through the television. The recorder has a tape counter to give the approximate position of a program and, as each recording has an 18 second leader, the precise location of the program start is not too critical.

The printer supplied was a 40-column impact machine with 5 x 7 matrix. With its on-board 6502, I reckon it could do more than I could find out. I managed to get the standard character set but no graphics. The documentation gives tantalising hints of more features, mainly to do with the ability to print horizontally and vertically but I couldn't get it to work.

Two other printers are available, a thermal 40-column device and an 80-column machine. All three printers use a paper roll which limits the scope of the machine a little.

The disk drive supplied was a 5¼" 90k single sided device whose origin appears to be Atari. I had a little peek inside and could find no manufacturer's references other than Atari itself. Up to four drives may be attached or, if you need more storage, a double density dual drive is available, giving about 160 kbytes per disk. Again, up to four of these drives may be attached, giving a total over 1.2 MBytes.

I consider the hardware to be very well made and certainly attractive enough to have in the home.

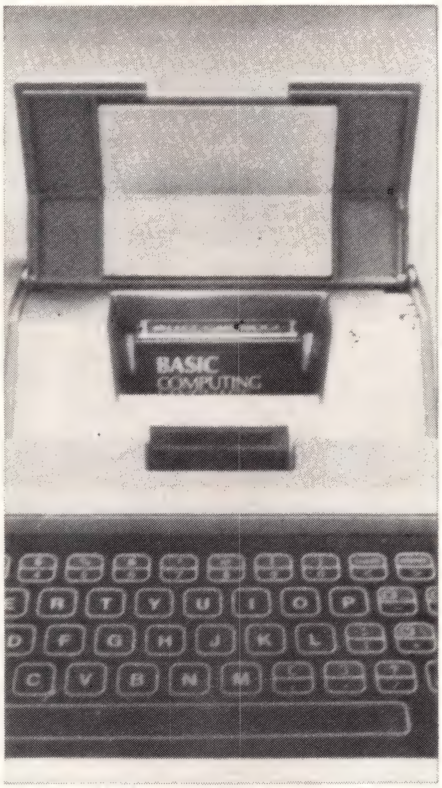
Software

The main operating system occupies a 10k ROM slot, the disk operating system is loaded from disk and takes up almost 9k of user RAM and the Basic cartridge occupies the RAM from 40 to 48k. At the moment games and other package modules occupy the same slot as the Basic cartridge.

Every package comes with an instruction booklet which can be quite substantial: a 12-page booklet explains the Star Raiders game for example. To digress for a moment, the Star Raiders game is similar to many of the Star Trek type games *except* the television screen gives what appears to be a three-dimensional view of space. In fact it creates the illusion of being the window of your spaceship. Believe me it's quite addictive and there are several levels of play, each rewarding you with a whole series of grades depending on your performance in your mission. It could take weeks, months even, to reach the highest rank of star commander.

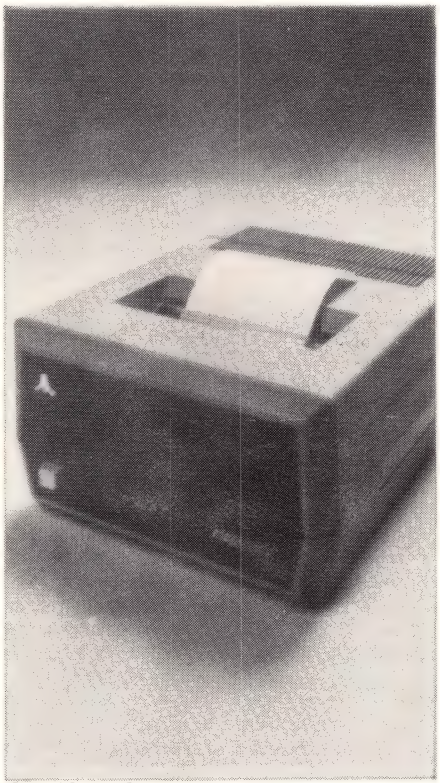
I've been told by someone who knows about these things that the programs available now are nothing compared with what's coming along.

Two program libraries exist, one for 8k programs and the other for 16k. The latter contains this new generation of games as well as new programming lan-

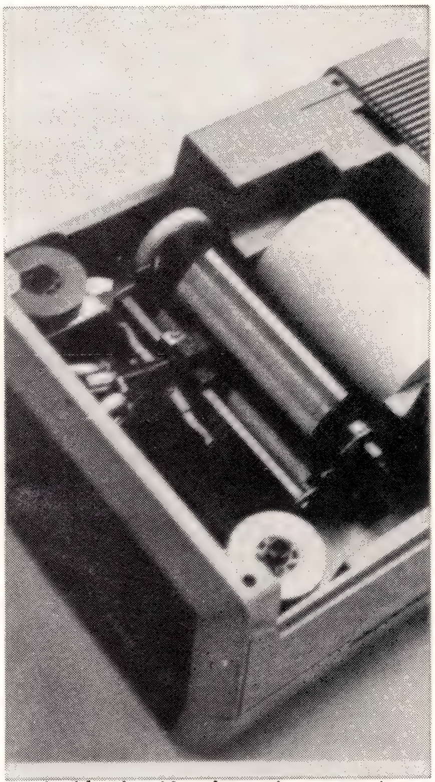


A close look at the 400 keyboard and cartridge slot.

The special Atari recorder.



Outside and. . .



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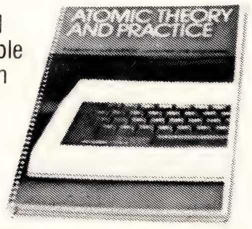

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guages and business information processing packages. An enormous amount of Talk and Teach courseware is being prepared, such as Basic Psychology, Basic Sociology, Effective Writing, Counselling Procedures, Supervisory Skills, Principles of Accounting, Principles of Economics, Spelling, History and so on. . .

A terminal emulator and an assembler/editor look like interesting cartridges to get hold of as well.

Basic

It would be impossible to give a full description of Atari Basic in this review. Instead I shall restrict my comments mainly to those aspects of the language which are different to the Basics normally encountered.

First of all a couple of points relating to program input and editing. Atari Basic checks command syntax quite carefully at the time of input and, if it detects an error, highlights it with a marker at the part of the line at fault. Unfortunately this admirable approach stops when programs are run. The user is presented with an error code number which has to be looked up in the manual. It's possible to use a reserved word as a variable name although Atari doesn't recommend it; I tried LET LET=10: GOTO LET, yes, you can GOTO a variable name. Finally CTL 1 allows you to freeze the screen (and program) and unfreeze it at will. This is great if the doorbell rings while you're in the middle of a fast moving game for example.

Saving and loading programs on cassette is quite neat; the keyboard 'peeps' once if you're to press PLAY and twice if PLAY and RECORD are to be pressed. A number of commands are available for these functions, LIST, CLOAD, LOAD, ENTER, CSAVE and SAVE. SAVE or LIST can record programs for later merging by the LOAD and ENTER commands. CSAVE saves a more compact version of the program.

Memory map

Operating system	FFFFH
Floating point routines	DFFFH
Hardware registers	D7FFH
Not used	CFFFH
Slot A or RAM	BFFFH
Slot B or RAM	9FFFH
Basic & RAM	7FFFH
DOS & RAM	2A7FH
System controls & RAM	12FFH
	0000H

The string functions are adequate but hardly exciting. For a start all strings must be defined using a DIM statement, thus turning each string into a single dimension array, as in Cromemco's 16k Basic. No string arrays (in the normal meaning of the term) are allowed, which can be a bit of a nuisance. On the bright side, there's no limit on the length of a string although substrings are limited to a maximum of 99 characters. Substrings may be concatenated but not with the usual '+'; on the Atari it is necessary to devise an expression such as Z$(LEN(Z$)+1)=A$; this adds A$ to the end of Z$. All string variables can be subscripted either with a single number or with two separated by a comma. A single character means 'from this character position to the end of the string', while two characters define the start and end positions within the string.

The INPUT instruction will accept commas as part of the string, unlike so many other Basics. Unfortunately the machine gives no warning if the string is too long for the space available to accept it — the poor thing is simply truncated. Another oddity about Atari Basic is that you can't include a prompt in the INPUT statement and it's necessary to precede it with a PRINT.

ADR returns the memory address in decimal of the start of any given string.

A matrix has a maximum of two dimensions as opposed to the more usual three. Unlike the ZX80 which can only work with integers, it is impossible to define integer variables on the Atari machine.

A nice feature is TRAP; this allows you to define an address to which program control must pass when an error is encountered — very useful. This must be reset with a new TRAP instruction following each error trapped.

Sensibly, Atari has included a POP instruction which enables you to remove the top entry from the stack, essential if you decide not to RETURN from a subroutine.

Disk handling is somewhat crude but nevertheless effective. It comprises three useful commands — NOTE, POINT and OPEN. I only mention OPEN because a file may be opened in append mode which is quite useful. The other two commands give direct control over where the disk is to be accessed. NOTE saves the current sector/byte combination while POINT sets internal pointers to the next sector/byte to be accessed. Think about it. Sadly I didn't see a DOS manual but I have been led to believe that file handling software is fairly non existent at present.

GET and PUT read or send one character to a specified device and the location pointer is then incremented by one.

Many instructions are quite lengthy so an XIO command has been provided to give a sort of shorthand. The required function is accessed by issuing an XIO with a command number selected from a table. It has one extra function not provided by any other command and that is to FILL a previously defined graphics area.

Surprisingly, user defined fuctions are not allowed in Atari Basic. There are, however, a number of functions, among which are RAD, DEG and CLOG. RAD or DEG selects whether results are to be in radians or degrees — the mode won't change until another RAD or DEG instruction is encountered. CLOG gives logarithms to base 10. Mathematics are to nine-place accuracy except for EXP which will be at least six.

The graphics on this machine more than make up for any minor deficiencies in the other departments. It is possible to select from 128 colour/luminance combinations and 17 different screen arrangements. Up to five colours may be displayed, depending on the particular graphics mode in operation. Table 1 gives the range of options together with their RAM requirements.

Two of the more useful commands are DRAWTO which draws a line from the last location plotted to the coordinates defined and SETCOLOR which is used to set each of the five possible colours. Mixed text and graphics are allowed, so it's necessary to move an 'invisible cursor' around the screen. This is done using the POSITION command; text sent to the graphics area will then appear at that position.

The graphics commands take a lot of effort to master but they are definitely worth it. You may even find a few modes that are not in the manual, as I did.

One look at the Basketball or Star Raiders games tells me that there are far more graphics facilities locked away inside the machine. Atari isn't telling though, so it will be left to some bright programmers to get inside the software and then to spill the beans. (To APC perhaps?) For now I would suggest you go to a pub or an arcade where Atari machines are installed to get some idea of their potential. One of the interesting features is the 'simultaneous' movement in different directions of large graphic figures (people, spaceships etc).

Up to four sounds may be played simultaneously; the pitch of each may be varied from one octave below middle C to two octaves about it. Special

Basic Reserved Words

+	—	*	/	∧	NOT		
BYE	CONT	END	LET	LIST	NEW	REM	RUN
FOR. . .TO. . .STEP. . .NEXT			GOSUB. . .RETURN		GOTO	IF. . .THEN	STOP
ON. . .GOSUB	ON. . .GOTO			POP	RESTORE	TRAP	
CLOAD	CSAVE	DOS	ENTER	INPUT	LOAD	LPRINT	NOTE
OPEN	CLOSE	POINT	PRINT	PUT	GET	READ/DATA	SAVE
STATUS	XIO						
ABS	CLOG	EXP	INT	LOG	RND	SGN SQR	USR
ATN	COS	SIN	DEG	RAD	ADR	FRE	POKE
ASC	CHR$	LEN	STR$	VAL		PEEK	SQR
DIM	CLR						
GRAPHICS	COLOR	DRAWTO	LOCATE	PLOT	POSITION		
SETCOLOR							
SOUND	PADDLE	PTRIG	STICK	STRIG			

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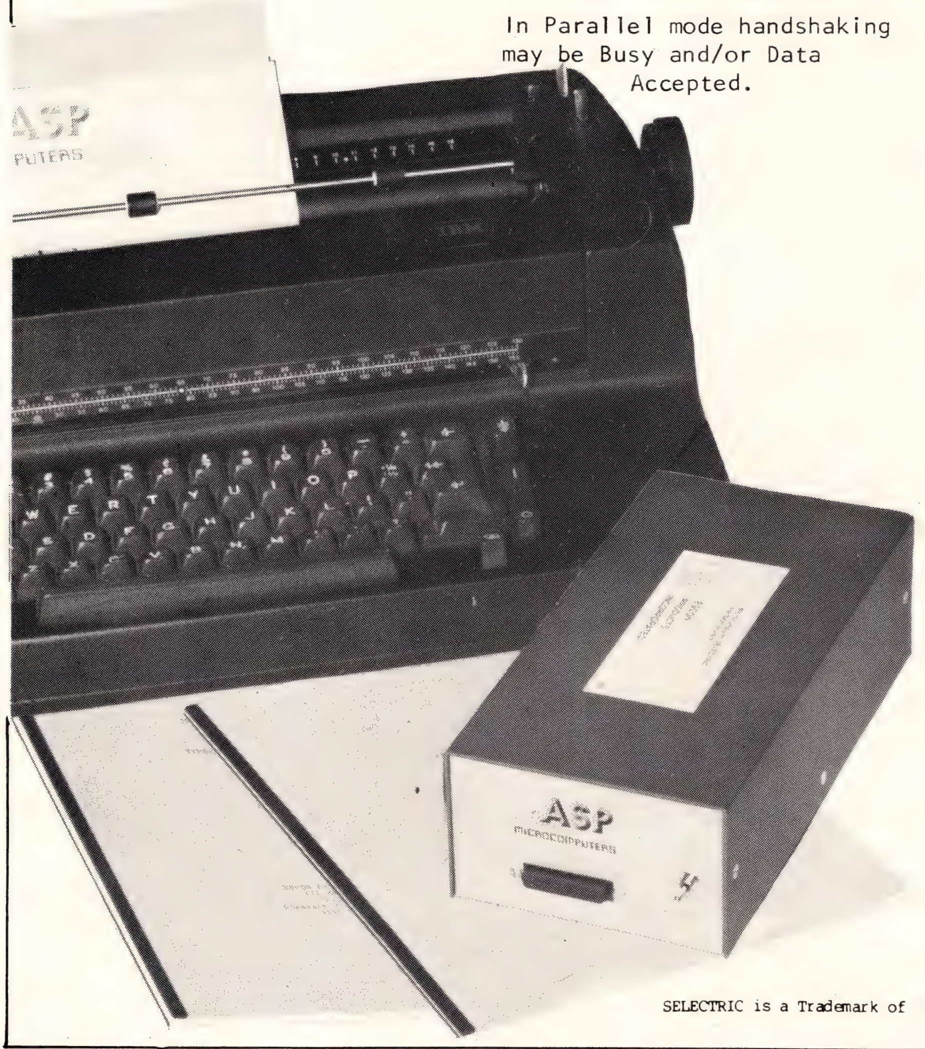
The Controller is based on a 6802 microprocessor and accepts data input on either RS232 or TTL parallel basis (selected when placing your order)

In RS232 mode baud rates of 110, 150, 300, 600, 1200, 2400, 4800 and 9600 are available. Serial data format is 1 start bit, 8 data and 1 stop bit. Handshaking may be RTS, RTS inverted or XON/XOFF.

In Parallel mode handshaking may be Busy and/or Data Accepted.



In both modes a buffer of 96 characters is provided and extensive self test capabilities are built in. Connection point on the Controller is the common 25 pin female EIA connector. Cables from the Controller to popular microcomputers are available at extra cost.

MAINTENANCE OF TYPEWRITER

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distortion effects and separate volume controls may be applied to each voice, using the SOUND command, and once a sound is initiated it will continue until stopped by a reset, END or another SOUND instruction for the same channel.

You will see from the Basic reserved words table that there are many commands not even hinted at here. In my view it's a good Basic with just the one or two limitations mentioned above.

The disk operating system (DOS) must be booted in before programming starts, which is very important, not least because the machine has to be switched off before DOS can be loaded. It was difficult for me to evaluate the DOS properly as I didn't have the DOS manual; all I can say is that it worked for me — I had no disk problems at all and I was saving and loading both programs and files. A menu can be displayed which shows that DOS offers the usual functions such as file copy, delete, rename, lock, unlock as well as disk level commands such as copy, write DOS to disk, format disk and duplicate disk. I was disappointed not to find mention of any file handling procedures as this would save each user reinventing this particular wheel.

Benchmark timings (all times in seconds)

BM1	2.35
BM2	7.41
BM3	19.89
BM4	23.16
BM5	26.78
BM6	40.75
BM7	61.51
BM8	43.08

Potential use

Without doubt this machine is aimed at the home user and education in its widest sense. The audio visual facilities will find a place in the home, in commercial training establishments as well as in the school. The games will be an attraction to those already interested in computing while at the same time involving those who wouldn't normally touch a computer with a barge pole. The home computeer will have a whale of a time while the more serious may reconcile their household accounts and taxes on it. The businessman may use it but probably only the smallest, the architect or engineer perhaps. The 400 should be ruled out for serious computing although it is ideal for games/computing/education. The 800 offers a more grown-up option with plenty of growth capability; disks and the RS232C interface will ensure that some quite serious users will buy.

Both machines are friendly, they have the solid backing of Atari and, behind it, Warner Brothers Communications.

Documention

A lot of effort has gone into the preparation of the documentation. It has been well produced although there is still some room for improvement. The operator's manuals are very clear as are the instructions for operating the various cartridges. A Basic manual written by Albrecht, Finkel and Brown was also quite excellent.

Aimed at the absolute novice, this book takes you through most of the various features and functions of Atari Basic. All except our friends the I/O commands, that is. Experienced programmers will probably dip into this book but I would recommend a beginner to work through it carefully. The Atari Basic reference manual is quite good for the experienced programmer but not a lot of use to the beginner except for the appendices which give all sorts of interesting information such as the derivation of mathematical functions in terms of Atari Basic, memory maps, useful POKE & PEEK locations, error codes and the various graphics modes.

I'd like to have seen more in Atari's own manual; I did feel that they skimped a bit on explanations, especially with regard to printer and disk operation.

Prices

Prices in Australia have not been finalized so I shall give Atari's "approximate anticipated retail" figures which include sales tax:

16k 400	$ 800
16k 800	$1400

No prices are yet available for the cassette recorder, disk drive, printer or cartridges.

The official Australian release for the machines is scheduled for June, although some mail orders may be filled before then.

Conclusion

I've said it all earlier in the review but for the benefit of those busy people who only read the introduction and conclusion, I think that Atari is doing a very professional job. The machines are clearly aimed at the home market where, as well as satisfying a demand for sophisticated games and Basic computing, they might spawn a completely new 'consumer education' boom. Self improvement is rapidly becoming a necessity and Atari seems set fair to help/capitalise depending on your viewpoint.

At a glance

***** excellent, **** V. good, *** good, ** fair, * poor.

FIRST IMPRESSIONS	
Looks	*****
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Ease of use	*****
LANGUAGES	
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System software	**
PACKAGES	
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Education	not reviewed
Home	****
PERFORMANCE	
Processor	**
Cassette	see text
Disk	**
COMPATIBILITY	
Hardware	**
Software	*
DOCUMENTATION	****
VALUE FOR MONEY	****

TECHNICAL SPECIFICATION

CPU: 6502, 1.8 MHz
Memory: 8-48k (16k limit on 400), 8k ROM Basic (40-48k RAM location) 10k ROM operating system.
Keyboard: Full qwerty + special keys. (61 keys including controls).
Screen: Domestic television. 12x20 to 320x192 resolution. Up to five selected from 128 colour/luminance combinations.4-channel sound
Cassette: Digital, 600 baud. Audio channel. Tape counter.
Disk drives: 5¼" 90k. 5¼" twin 160k drive. Up to 4 drives per system.
Printers: 40 col impact or thermal, 80 col impact.
Ports: Interface module gives RS232C. VCR socket on 800 (can be used for a monitor). 4 games controller/light pen sockets.
System S/W: 10k operating system. 9k (almost) DOS in RAM.
Language: 8k Basic (others coming)

	Graphics mode	Columns	Rows Full	Rows Split	No. of colours	RAM required
Text	0	40	24	—	2*	993
	1	20	24	20	5	513
	2	20	12	10	5	261
mixed text/ graphics	3	40	24	20	4	273
	4	80	48	40	2	537
	5	80	48	40	4	1017
	6	160	96	80	2	2025
	7	160	96	80	4	3945
	8	320	192	160	1*	7900

* 2 luminances may be defined for one colour
4 text lines are provided at the foot of each split screen.

Table 1 Graphics options

BENCHMARKS

We have received a large number of requests for details of the Benchmark programs used in our Benchtests so we're reprinting them here. You'll also find the timings for machines Benchtested since May last year, including those in this issue.

The Benchmark programs, originally published in *Kilobaud*, are fairly self-explanatory and provide a rough rule-of-thumb guide to the efficiency of the machines' Basic interpreters and, to a lesser extent, to the efficiency of certain aspects of hardware design. They should be interpreted as such, and not used as absolute guides to which machine is 'better' than another; this is a decision which involves a great many factors and which can only be arrived at by studying the full Benchtests and by forming a clear idea of which machine is best suited to the purpose to which you intend to put it.

The disk Benchmark timings which were introduced earlier this year have not been listed, and neither have the disk timings been reproduced here as they do not apply to all machines. As different dialects of Basic have such widely different disk I/O formats, we cannot provide listings of a specific suite of programs which can run unaltered on any machine. Here, however, is a summary of what the disk tests do:

Test 1 OPEN a new file, then immediately CLOSE it.

Test 2 Using a FOR . . . NEXT loop, fill two strings, A$ and B$ with 128 As each; OPEN an existing file; using a FOR . . . NEXT loop, fill each of the 100 records, each of which contains two fields of 128 characters, with A$ and B$ in ascending order; CLOSE the file.

Test 3 Identical to Test 2 except that the records are written in reverse order.

Test 4 OPEN the file; read records 1 to 100 into A$ and B$; CLOSE the file.

Test 5 Identical to Test 4 except that the records are read in reverse order.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
Compucolor II	2.0	10.9	22.4	23.9	25.7	38.7	55.2	10.8
Cromemco System Three	1.9	5.7	16.4	19.7	21.3	32.4	44.1	22.9
TRS-80 Model II (Int)	1.0	4.0	13.0	13.0	14.0	20.0	30.0	6.0
(S/prec)	1.0	5.0	13.0	13.0	14.0	23.0	35.0	6.0
(D/prec)	-	6.0	41.0	43.0	44.0	52.0	65.0	7.0
HP-85	1.8	3.8	16.3	16.5	17.7	30.0	44.8	12.7
TI99/4	2.9	8.8	22.8	24.5	26.1	61.6	84.4	38.2
Sinclair ZX80	1.46	4.69	9.18	8.95	12.7	25.9	39.2	-
CBM 8032	1.7	10.0	18.4	20.3	21.9	32.4	51.0	11.9
Superbrain	1.6	5.2	14.0	13.9	14.8	26.3	43.2	5.6
Atari 400/800	2.3	7.4	19.9	23.2	26.8	40.7	61.5	43.1
The following machines have not been reviewed by APC but are included for interest.								
TRS-80 Model I	2.5	18.0	34.5	39.0	45.0	67.0	109.0	-
PET	1.7	9.9	18.4	20.4	21.0	32.5	50.9	12.3
Apple II	1.3	8.5	16.0	17.8	19.1	28.6	44.8	10.7
Sorcerer	1.8	10.0	20.7	22.2	24.3	37.6	53.7	9.6

S/prec = Single precision
D/prec = Double precision

All timings in seconds.

BM1
```
300 PRINT “S”
400 FOR K=1 TO 1000
500 NEXT K
700 PRINT “E”
800 END
```

BM2
```
300 PRINT “S”
400 K=0
500 K=K+1
600 IF K<1000 THEN 500
700 PRINT “E”
800 END
```

BM3
```
300 PRINT “S”
400 K=0
500 K=K+1
510 A=K/K*K+K-K
600 IF K<1000 THEN 500
700 PRINT “E”
800 END
```

BM4
```
300 PRINT “S”
400 K=0
500 K=K+1
510 A=K/2*3+4-5
600 IF K<1000 THEN 500
700 PRINT “E”
800 END
```

BM5
```
300 PRINT “S”
400 K=0
500 K=K+1
510 A=K/2*3+4-5
520 GOSUB 820
600 IF K<1000 THEN 500
700 PRINT “E”
800 END
820 RETURN
```

BM6
```
300 PRINT “S”
400 K=0
430 DIM M(5)
500 K=K+1
510 A=K/2*3+4-5
520 GOSUB 820
530 FOR L=1 TO 5
540 NEXT L
600 IF K<1000 THEN 500
700 PRINT “E”
800 END
820 RETURN
```

BM7
```
300 PRINT “S”
400 K=0
430 DIM M(5)
500 K=K+1
510 A=K/2*3+4-5
520 GOSUB 820
530 FOR L=1 TO 5
535 M(L)=A
540 NEXT L
600 IF K<1000 THEN 500
700 PRINT “E”
800 END
820 RETURN
```

BM8
```
300 PRINT “S”
400 K=0
500 K=K+1
530 A=K↑2
540 B=LOG(K)
550 C=SIN(K)
600 IF K<100 THEN 500
700 PRINT “E”
800 END
```

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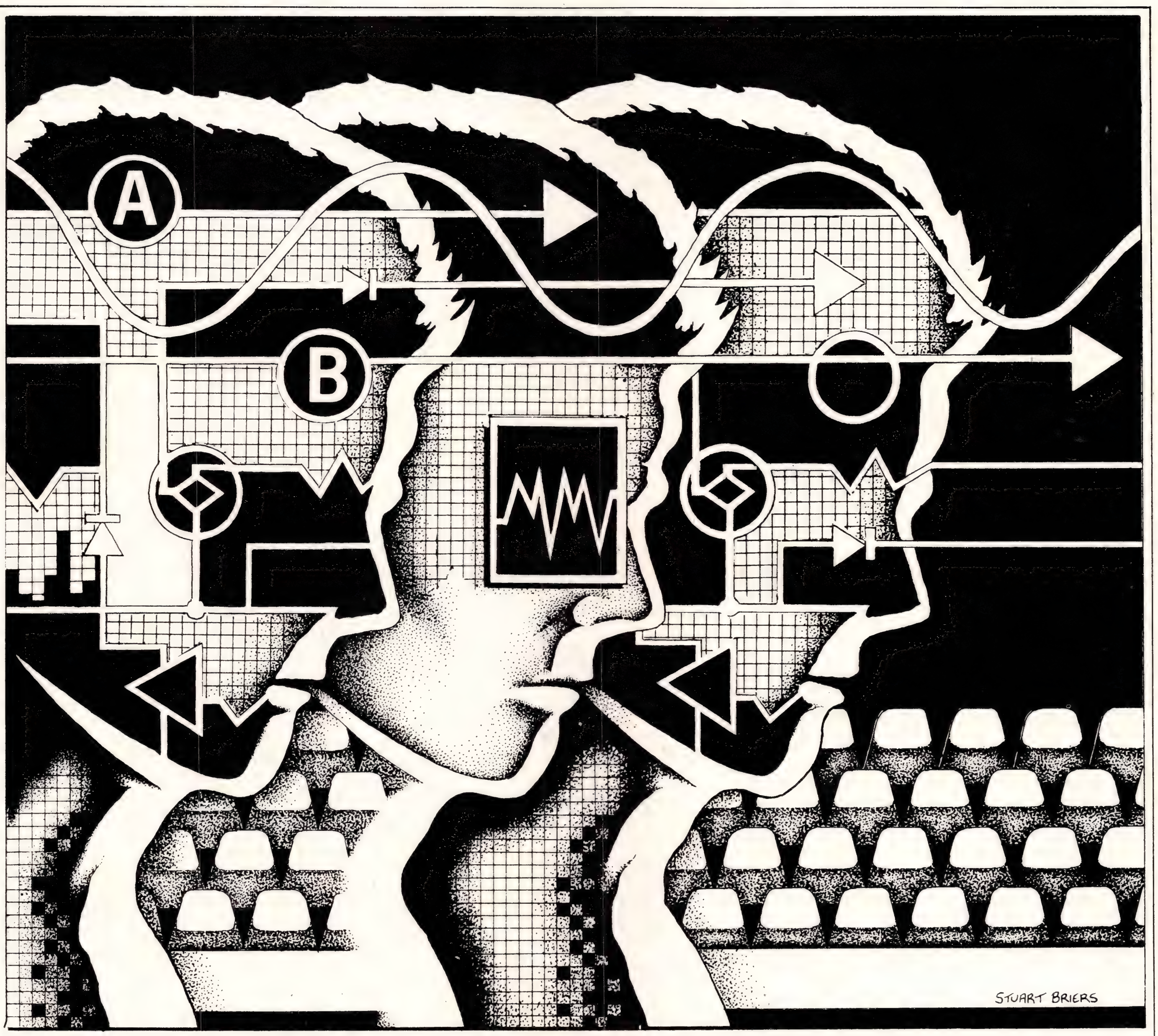

SYSTEMS DEVELOPMENT

by Jon Patrick

Many people who own microcomputers are interested in developing and selling software but do not know how to approach the job of doing so. This article and the three that follow in later editions give an outline of the professional approach to the development of a complete computer system.

The articles cover general procedures for project development using, for illustration, the CompuSport Football System which was designed by the author.
The first article discusses the process of a simple systems analysis. The second article deals with system design and the third describes program development and implementation. The fourth article will cover the installation and testing of a system.

PART 1: INVESTIGATION AND ANALYSIS

The initial restriction in designing any microcomputer system is the budget available as this provides constraints not only on the equipment but also on the level of sophistication of the system. A category 1 microcomputer (for the different categories see J. Patrick, "Marketing Strategies of Microcomputer Manufacturers", APC, Vol.1, No.5, pp. 15-17) would cost from $1500 to $4000. At the lower end of the scale, a $2000 budget would restrict you to a microcomputer of limited memory, perhaps with one disk drive. A budget of $4000 would permit a dual drive system which would enable quite different design features. Both of the above systems would be completely screen-oriented with no facility for outputting information to a printer, as it would cost in excess of $1000 to add a reasonable printer.

The cost of a category 2 microcomputer would range from $4500 to $7000, and it would offer a similar hardware configuration to that of a category 1 with a more sophisticated operating system. As well, better screen display facilities would enable a more user friendly screen processing system. Between $8000-$12000 would bring you into the category 3 range of computers, allowing extensive language operating system capabilities with wide room for expansion.

The study and definition of business systems, or any other form of data collection and processing, is called *systems analysis*. A study of the techniques used by Systems Analysts will be of considerable help in the design of your system. The various stages of system

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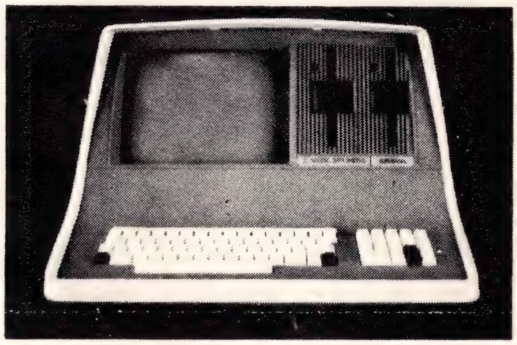

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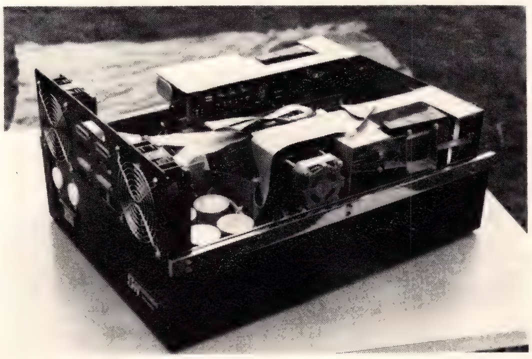

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analysis, as well as feedback paths, are depicted in Fig.1. Designing is a creative process that carries the designer's personal skills and trademark. As each stage is completed, previous stages are reassessed in the light of broader understanding of the problems. These feedback processes are important to the successful completion of any project.

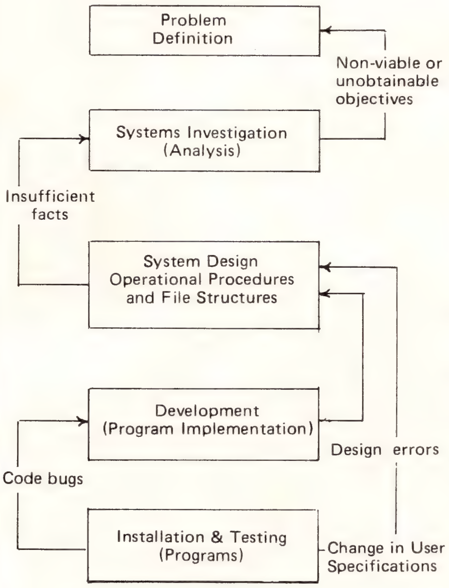
Problem Definition
Non-viable or unobtainable objectives
Systems Investigation (Analysis)
Insufficient facts
System Design Operational Procedures and File Structures
Development (Program Implementation)
Design errors
Code bugs
Installation & Testing (Programs)
Change in User Specifications

Fig.1: Systems Analysis Cycles with Feedback

The first stage of any project is to produce a problem definition, achieved by an iterative cycle. Without such a definition you run the risk of creating a system that fulfils no useful activity and so is futile, or worse, a hinderance to the final user. The problem consists of:

(a) defining objectives in an assignment brief;
(b) making a feasibility survey, and
(c) presenting a report on the feasibility of the system.

If the report indicates difficulties with meeting some of the objectives then you move back into the cycle with new or revised objectives. Often with small systems the feasibility is not in question, so once the objectives are clearly defined the analyst goes onto the system investigation stage.

The feasibility survey has four purposes. Firstly, the realism of the assignment is very important. Most things are attainable given unlimited time, but in practice time constraints mean that aims must be very carefully tailored. Secondly, if more than one person is to work on the project then the work areas of each individual have to be defined and scheduled, especially if different parts of the project have to be dovetailed. Thirdly, the survey should highlight any areas in the current system where there is scope for improvement. These improvements may be in areas not generally recognized as problem areas. And fourthly, the feasibility survey should determine whether external expertise is necessary, particularly, if any large problems can't be solved by conventional methods.

The Systems Analyst studies a business, documenting the activities of employees, investigating usage and movement of documents, and the activity cycles and procedures of the business.

The analyst is then able to cost the existing system. The development of a microcomputer system for a particular application will probably only require one or two people for its operation, and involve fewer than ten documents. In such cases, elaborate documentation such as document description forms and data usage grid charts are best dispensed with. Two very useful tools are the systems flow chart and the systems runchart. Special symbols are used to represent the various basic activities in both manual and computer systems. This article will only discuss systems flowcharts as far as they were used in the CompuSport Football System but further reference texts are listed at the end of this article.

The CompuSport Football System was developed to assist in managing the administration of the rapidly expanding Frankston and District Junior Football League. This League has about 2500 registered players, from 16 clubs who field 96 teams, and competitions are run from U/10 to U/15 age groups. The major data processing problem is maintenance of weekly records crediting each player with games in which he has participated. A secondary processing activity is the compilation of the premiership ladders from the games results each Sunday afternoon.

The League President initially envisaged a system that had a card for every registered player. Each player who participated in a game would have his card passed through the card reader, and the information would be automatically updated. With this idea in mind, and a budget of $4000, he visited the 1979 Melbourne Home Computer Show to discuss his proposal with vendors. As a prospective customer he found them unprepared to listen to his requirements, adament that their equipment could do anything he wanted, derisive about his wish to use a card reader and caustic about getting anything suitable within his budget. After discussing the League's requirements and surveying all the microcomputers readily available, the field was narrowed down to the Apple and Ohio ranges. The Ohio offered a definite price advantage over the Apple, but didn't seem to have good hardware support in Melbourne, or any card reader equipment. So the Apple was recommended. The estimates of the programming costs were around $2000, bringing the total hardware and software costs to about $6000.

Preliminary analysis

The preliminary discussions about the manual system showed that the most complicating factor in recording the games was that it was not uncommon for players to participate in one or two age groups as well as their usual age group. The problem to be resolved was whether to keep a separate record for a player in each age group file or have only the one record with fields available for all possible competitions. Obviously the solution was the cornerstone of the whole system design. It was produced by a most unconventional process.

Once it had been established that the Apple with one disk drive and a card reader could fill the League's needs and projected expansion, the whole proposal was put to a meeting of 30 League delegates. The equipment was brought in for a demonstration and then the delegates' queries about the tasks the computer could perform were discussed. It was in this discussion that the player record format was established. Although most of the delegates had no experience with computers, they quite capably discussed the system requirement and clearly defined their needs. The whole exercise turned out to be very effective design by consensus. After the meeting, one delegate proposed a screen layout of the player record which ultimately was used with only minor modification. Furthermore, another delegate persuaded the President to give up his idea of using a card reader and buy instead a second disk drive and use the keyboard for all input. The delegates approved the purchase of the system by a vote of 15-1. Interestingly, the dissenting Club claimed that either a pensioner or an unemployed youth could be paid $10-$15 per week to do the necessary paper work. In the manual system the Records Secretary

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spends 8-10 hours per week maintaining the player records.

System investigation

The definition of the manual system involved long discussions with the League President and Records Secretary. Copies of all documents used in the manual system were collected and descriptions of their uses tabled. This information was utilized in the compilation of system flowcharts which gave a simple pictorial representation of the components of the system.

The management of most sports is divided into two distinct activities. The first is registering players and keeping a record of their participation. The second activity is recording scores and compiling ladders each week-end. Figure 2 is a simple system flowchart depicting the latter. It summarises the files kept in the system, and the input and output documents. A similar flowchart was drawn up for the player record operations. A full system flowchart would contain many other symbols showing the actual sequence of operations in the use of each input document, and the updating of the master files and generation of the output files.

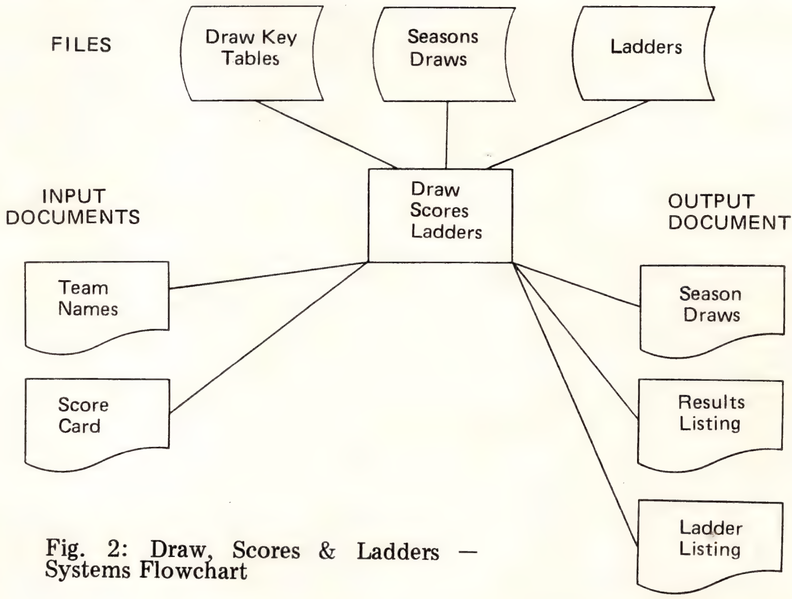

Fig. 2: Draw, Scores & Ladders — Systems Flowchart

From the investigations, a 10 page report was produced defining the various administrative tasks carried out by the League officials, the rules governing the eligibility of players to participate in competitions and the information required for the player records. Also, the report listed all the regulations and data fields for the seasonal draw, weekly scores and ladders. The report was submitted to the League officials for their scrutiny and it was emphasized that the final system would conform very closely to the requirements specified in the report. Only minor modifications were made to the report.

SYSTEMS ANALYSIS REFERENCES

Clifton, H.D., "Business Data Systems", 1978, Prentice-Hall.

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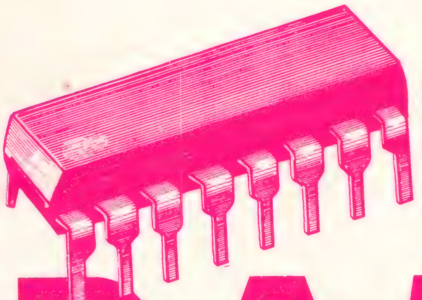

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13) Dated files. —— All files are accompanied by the date of their last modification (creation or write).

14) Marked files. —— All files are accompanied by a 'mark' if they have been modified since they were last backed up. This permits the BACKUP utility to copy only those files which have actually been updated since a previous backup.

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17) User may SYSGEN a custom VTOS system configuration containing special I/O drivers, device LINKing and ROUTEing, SPOOLing and DEBUG tasks, etc. which will be automatically loaded during the BOOT process without requiring a more lengthy AUTO and CHAIN procedure.

18) Non-BREAKable AUTO and CHAIN commands.

19) Wild-card DIRectory. Permits you to locate all files of a certain classification such as '/BAS'. Uniformly indicates file size in K (1024 bytes) regardless of drive type. "DIR D" would give you all your files that start with "D".

20) Dynamic file name defaults in APPEND, COPY, and RENAME commands allow you to specify only minimal information about file names.

21) COPY and APPEND commands execute up to 300% faster.

22) ALLOCate command for pre-allocation and non-releasibility of file space. File space will never shrink if this option used.

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CISA HIRES-80

Ian Davies examines another high resolution modification for the TRS-80

Introduction

The HIRES-80 modification for the TRS-80 is an internal printed circuit board which fits snugly into the keyboard unit without any external switches, cables or additional power-supplies. It is designed and manufactured in Australia by CISA Microcomputing and adds a graphics capability which greatly enhances the standard TRS-80 "chunks". With this modification installed, the TRS-80 can generate high-resolution graphics equivalent to 384 horizontal by 192 vertical pixels or points.

A unique feature of this board is the permanent lower-case facility which solves many of those baffling syntax errors in apparently error-free Basic lines caused by the TRS-80's inability to correctly interpret a lower-case letter embedded in a Basic statement, string or variable name.

Hardware

My first impression is that installation is not for the absolute novice. It is essential to have some experience with electronic kit-building, particularly in soldering ICs, to fit this modification.

The assembly instructions are quite straight forward, however, and are more than adequate to guide the average electronics hobbyist. The authors of the installation documentation have assumed some competency in electronic skills on the part of the purchaser, so if you don't feel up to it, I would suggest you have the unit fitted by the manufacturer (or a competent friend).

The circuit board is a high-density assembly with the equivalent of 17 integrated circuit packages on a board measuring 6 x 13cms. The board fits snugly into the right-hand leg recess of the TRS-80 keyboard, which has necessitated the use of several jumper-wires from the board, in view of the space restrictions inside the Tandy keyboard cabinet.

Installation essentially consists of piggy-backing a number of 16 pin DIP-header connections onto existing ICs in the keyboard PC, soldering a number of single jumper-wires and cutting three PC board tracks.

The HIRES-80 board carries its own memory and therefore doesn't interfere with any of the existing functions resident in the standard system. High memory remains completely untouched, so any existing printer-drives, or other high-memory utilities, run normally. The unit comes well packed on a foil backing in a crush-proof mailer carton, with installation instructions, software documentation and some interesting demonstration programs.

Software

HIRES-80 is supplied with a graphics editor program to simplify the creation of individual characters. It displays a large 6 x 12 grid on the video which uses a fully addressable cursor to fill in or edit any of the 72 points while the created character is simultaneously drawn life-size in the upper right-hand corner of the screen.

The editor program has several unusual features. It displays the DATA required to rebuild the displayed character in the user's Basic program. The user then has to write down the DATA statements and retype the line into his/her own program. A disadvantage is that there is no hard-copy facility to record the DATA statements, but as the editor program is written in Basic it shouldn't be too difficult to modify. The lower-case facility is, to my knowledge, unique to the TRS-80. Unlike other lower-case modifications, the TRS-80 generates true lower-case capability on the video, in Basic statements and strings, a facility usually only found on quite sophisticated terminals.

Normal operation is the reverse of the standard typewriter format. Shifted keys produce a lower-case character on the video or insert a lower-case character into a string. This means that the TRS-80 will now recognize and interpret both upper and lower-case characters in either Basic statements or variables. How many times have you stared at an apparently correct Basic statement which generates a SYNTAX ERROR for no obvious reason? In many cases this is because the statement contains a lower-case character which arose by inadvertently hitting the shift-key when typing in a Basic line. HIRES-80 calls a ROM routine which interprets either upper or lower-case characters as correct Basic syntax.

Over 20 new PRINTable characters are available to the user which were previously inaccessible. (These characters are part of the standard set of the TRS—80 character generator but were never utilized by the hardware designers.) However, owners of the Tandy lower-case kit are not so fortunate: these additional characters are deliberately masked out by the new character generator. The modification allows the user normal TRS-80 graphics operation as well as enhanced graphics capability. The mode of operation is selected by a memory-mapped Mode Select Latch

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located at 13427Dec (3473HEX). The computer is toggled between three available modes of operation — normal, HIRES and programming mode — by POKEing into this location certain predetermined values. Although the above address sits within the Stringy-Floppy's resident firmware, the manufacturers claim that this produces no incompatibilities with either units' operation.

Full alpha-numerics, upper and lower case, are available in both normal and HIRES mode. The HIRES mode is used to display previously programmed characters, which are created when the latch is in the programming mode.

Soon to arrive will be a series of more sophisticated disk-based utilities. These are said to include capabilities to 'chain-in' multiple character sets during the execution of Disk Basic programs as well as a more powerful machine-language graphics editor. It will allow the storage of several character-sets which can be called from Basic in conjunction with the HIRES chain facility.

Word processing

The manufacturers state that the modification is totally compatible with current word processors on the market for the TRS-80, including the popular Scripsit and Electric Pencil. But Electric Pencil still requires that famous (infamous?) control key to exploit all the lower-case facilities. For some lucky owners this can be overcome by using Pencil with the VTOS 4.0 patch.

Owners of Tandy's Editor Assembler Vers 1.1 and Vers 1.2 will experience some difficulty with HIRES-80 as this particular piece of software is incapable of handling lower-case directly. Apparently a solution has been found and is available at no charge to assembly buffs.

Conclusion

This Australian designed and manufactured modification for the TRS-80 retails for $225 with an extra (optional) $25 installation fee.

Against HIRES-80 are that its installation invalidates Tandy's 12 month warranty and it's not modular, so it cannot be disenabled easily. Another less important consideration is that any DMA devices using memory locations in about the first 2k of reserved RAM may interfere with the HIRES-80's operation.

Its major advantages over its competitors are no loss of any Basic statements and no encroachment on the top 1k of RAM in a 48k machine (how serious a disadvantage this might be is best left up to the individual user).

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CHAPTER 7 PROCEDURES AND FUNCTIONS

Throughout this series we have used procedures *to break programming problems into collections of interlinked but self-contained modules. This chapter seeks to examine the different means of interlinking such modules and thereby to analyse the different roles which they play in* modular *program design.*

Introduction

If something has to be done several times within a program, perhaps under different conditions or within different contexts, it can either be coded over and over again, whenever it is required or it can be coded once only and initiated from those points in the rest of the program where it is needed. In consequence, even the most elementary assembly languages usually provide some method of dividing a program into modules (or *subroutines)* and of interrupting the normal linear program flow by a subroutine call to some piece of code remote from that section currently being executed. However, it is one thing for a programmer to use such a facility as a convenience, when the occasion arises, and entirely another deliberately to design a program as a hierarchy of interdependent subroutines each with a specific if limited role within the whole program task.

The advantages of this approach to program writing emerge from a consideration of the process of producing and running a program in general. Firstly the task is hierarchically divided and subdivided into successively more detailed modules each of which has a well-defined, yet limited goal. If the goal is well-defined, the subroutine will be easy to code correctly. If the goal is limited, the subroutine will be more likely to produce the correct results and in addition makes the logical structure of the whole program simpler. Secondly, execution errors will pinpoint the subroutines within which they occur so that debugging a program fragmented in this manner is reduced to debugging one or two offending subroutines. Thirdly, features of the program which depend on special machine, peripheral or operating system characteristics are likely to be concentrated into a few subroutines which can be adapted to another computer environment without disturbing the rest of the program. Likewise, when transferring to a machine with limited memory, *overlaying* (i.e. the splitting of a program so that only a portion is resident in memory at any given time) is greatly assisted if the program is modular.

Finally, designing programs in this way imposes a discipline on the programmer which reflects itself in a logical and consistent approach to programming problems. This means that programs are easier to read and understand by other people. In *block-structued languages* which are designed to exploit this philosophy (and of which PASCAL is a member) the program consists of a number of procedures, within which may be *nested* other procedures, all controlled from the main program block. Variables declared within a procedure are local to the procedure and have no value outside the scope of that procedure.

Several important points arise from a consideration of the technical mechanisms necessary to achieve a satisfactory transfer of control from procedure to procedure. It is fairly simple to call a procedure — the procedure name is associated with the address of the first statement of the procedure so that, when the procedure is called, this address can be loaded into the program counter and processing can continue. However, getting back to the calling point when the procedure has finished is more difficult since the actual execution of the procedure will have altered the "state" of the processor.

For instance, the address of the statement immediately *following* that which initiated the procedure has to be loaded into the program counter for processing to continue after the called procedure has finished. However, the procedure could have been called from anywhere within the program and cannot "know" in advance what point control is supposed to return to. Therefore, during the execution of the called procedure, the *return address* must be stored somewhere out of reach of the current procedure but available immediately it has finished. Likewise any other special conditions which hold at the moment of the procedure call (e.g. the contents of some or all of the processor registers) must be preserved before the procedure is called and must be reinstated at the point of return.

In order to guarantee the preservation of this information, most modern processor architectures and language implementations provide the processor with a *run-time stack* for use as immediate *working space* during program execution. The essential feature of the stack is that only the latest element *pushed* onto the stack is accessible to the processor and anything further down the stack is consequently "safe" from interference. The processor communicates with the stack through a *stack pointer* which contains the first free address above the top (i.e. latest) element on the stack. The processor can access the last element by *popping* it off the stack (and decrementing the stack pointer) or can push another element onto the stack (and increment the stack pointer).

Every operation which uses the stack must ensure that everything pushed onto the stack is popped off before it finishes. In this way when a procedure exits, it will leave the stack in exactly the state in which it found it. If the return address therefore was pushed onto the stack *before* the procedure was called, it can now be popped off, loaded into the program counter and processing can continue. The region of the stack *above* the return address becomes the current procedure's private working space within which the local variables can be established and intermediate results can be stored. The diagram in Box 1 shows a representation of a stack when a nested procedure is being executed.

The current procedure can access any varaibles currently in the stack although when it exits its own local variables will be popped off the stack and hence lost.

Procedures that perform a job

The fact that the current procedure can access any variable on the stack and not just its own local variables is something of a mixed blessing. On the plus side, the current procedure will often require data from procedures further down the stack and it is convenient, in assignment statements and the like, to be able to refer to these variables in a straightforward way. On the minus side however, the further down the stack these variables are declared, the more searching and manipulation is required for each access. In addition, an assignment made to one of these non-local variables will stand even after the current procedure exits. This is known

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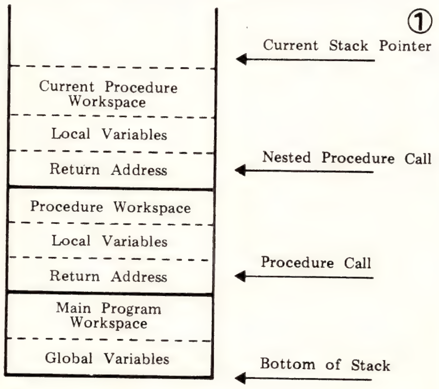

as a *side-effect* and is all very well if deliberately done by the programmer but a difficult error to trace if it happens inadvertently.

As a consequence it is necessary to make a distinction between those procedures which are required to produce a result and those which merely perform a job. A simple example of this latter category, with which we shall be concerned in this section, might be a procedure to print a line of dashes across a line-printer page. Such a procedure appears in Box 2 where PRINTLINE will produce the desired output when called from some other part of the program, as shown. The local variable I counts the number of dashes — 120 are printed out, this being the width of a typical line-printer page. However, some line-printers are 132 characters wide while matrix printers may have 40, 64, 72 and 80 character line widths, so if PRINTLINE were to be part of a package designed to run on a variety of systems, something would have to be done to customize (or personalize) the package to an individual user's system.

One approach whould be to go through the code changing every occurrence of 120 to the desired value. This, of course, is time consuming, prone to errors of omission and not a serious option, particularly when an alternative is simply to create an integer variable (say LINEWIDTH) which the user is asked to set at the beginning of the program. All output can thence be customized to the terminal merely by *referencing* LINEWIDTH (e.g. line 6, Box 2 would read:

FOR I : = 1 TO LINEWIDTH DO).

Since LINEWIDTH is a global variable it appears at the bottom of the stack and so is accessible to any procedure which is subsequently called. Provided the procedure only *uses* such non-local variables and doesn't change their values, this is a reasonably satisfactory way of allowing a procedure to communicate with external data.

Suppose, however, that one wished to write a procedure to produce a histogram, the data for which was stored in an array HEIGHT [1 .. 10]. Box 3 shows two methods of programming such a procedure. In program SIDEFFECT, procedure LINEOUT1 references the global array elements HEIGHT [I] and the global integer I. Consequently, each time HEIGHT [I] is needed, a search must be made, down to the bottom of the stack, first to find the value of I and then to get the contents of HEIGHT [I]. This must occur for ten iterations. In a large program where the arrays, procedures and hence the

②

```
 1:      --
 2:      --
 3:      PROCEDURE PRINTLINE;
 4:      VAR I:INTEGER;
 5:      BEGIN
 6:           FOR I:=1 TO 120 DO
 7:              WRITE('-');
 8:           WRITELN
 9:      END;
10:      BEGIN (*MAIN PROGRAM*)
11:      --
12:      --
13:      --
14:      IF LINENUM<60 THEN PRINTEXT
15:                      ELSE PRINTLINE;
16:      --
17:      --
18:      --
```

③

```
 1:      PROGRAM SIDEFFECT;
 2:      VAR HEIGHT:ARRAY[1..10] OF INTEGER;
 3:           I:INTEGER;
 4:      --
 5:      --
 6:      (*PROCEDURE TO FILL HEIGHT*)
 7:      --
 8:      --
 9:      PROCEDURE LINEOUT1;
10:      BEGIN
11:           WHILE HEIGHT[I]>0 DO
12:           BEGIN
13:                WRITE('H');
14:                HEIGHT[I]:=HEIGHT[I]-1
15:           END;
16:           WRITELN
17:      END;
18:      --
19:      --
20:      BEGIN (* MAIN PROGRAM *)
21:      --
22:      --
23:           WRITELN('RESULTS HISTOGRAM:');
24:           FOR I:=1 TO 10 DO
25:           BEGIN
26:                IF I<10 THEN WRITE(' ');
27                 WRITE(I,'     !');
28:                LINEOUT1
29:           END;
30:      --
   ***-----------------------------------***
31:      PROGRAM CALLBYVALUE;
32:      VAR HEIGHT:ARRAY[1..10] OF INTEGER;
33:           I:INTEGER;
34:      --
35:      --
36:      (*PROCEDURE TO FILL HEIGHT*)
37:      --
38:      --
39:      PROCEDURE LINEOUT2(J:INTEGER);
40:      BEGIN
41:           WHILE J>0 DO12:           BEGIN
42:                WRITE('H');
43:                J=J-1
44:           END;
45:           WRITELN
46:      END;
47:      --
48:      --
49:      BEGIN (* MAIN PROGRAM *)
50:      --
```

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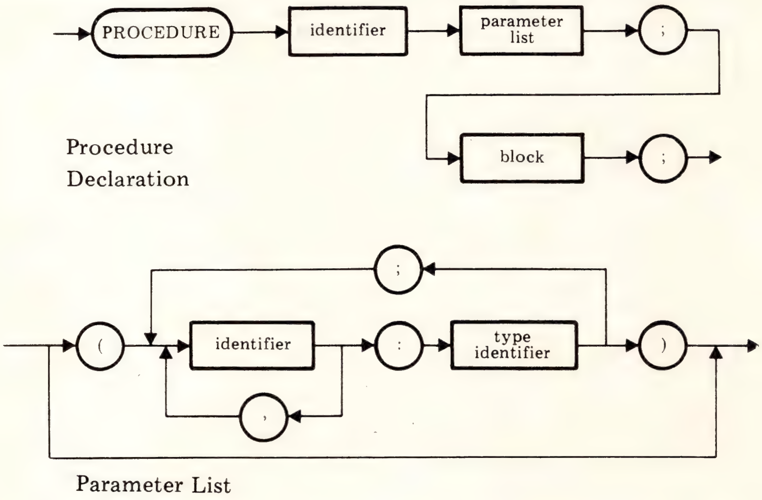
```
51:     --
52:          WRITELN('RESULTS HISTOGRAM');
53:          FOR I:=1 TO 10 DO
54:          BEGIN
55:               IF I<10 THEN WRITE(' ');
56:               WRITE(I,'     !');
57:               LINEOUT2(HEIGHT[I])
58:          END;
59:     --
60:     --
```

Box 3 (continued)

④



Procedure Declaration

Parameter List

⑤

```
--
VAR EVEN:BOOLEAN;
PROCEDURE PROCEVEN(VAL:INTEGER);
BEGIN
     EVEN:=2*(VAL DIV 2)=VAL
END;
--
--
BEGIN (* MAIN PROGRAM *)
--
--
     PROCEVEN(VAL);
     IF EVEN THEN ....
--
--
***-----------------------------------------------------***
--
FUNCTION EVEN(VAL:INTEGER):BOOLEAN;
BEGIN
     EVEN:=2*(VAL DIV 2)=VAL
END;
--
--
BEGIN (* MAIN PROGRAM *)
--
--
     IF EVEN(VAL) THEN...
--
--
```

stack itself can be expected to be much larger, the inefficiency of this method becomes amplified.

The second verion of the program in Box 3 is intended to show how specific values may be *passed* to a procedure when it is called. This implies that the called procedure will make its own local copy of the value in its own work space at the top of the stack. Thus the call LINEOUT2 (HEIGHT [I]) in line 57 passes the *actual parameter* value (i.e. the contents of HEIGHT [I]) to produce LINEOUT2 which uses the local *formal parameter* J to reference that value. Every time J is accessed it can be found at the top of the stack so the search is shorter than the corresponding search in program SIDEFFECT. LINEOUT2 alters the value of J as it proceeds but this change does not affect HEIGHT [I] since, when LINEOUT2 exits all its work space (including the current value of J) is returned to the free space above the top of the stack.

This technique of passing useful external values to a procedure for use in its own work space is known as a *call-by-value.* The formal definition is shown in the syntax diagram in Box 4. Note that formal parameters may be of any type and that more than one may be passed.

Exercise: Write a procedure which will cause the line printer to skip 'm' lines and which is called by the statement NEWLINE (N)

Procedures which produce results

Using a procedure with parameters that are called by value is quite satisfactory unless the results computed by the procedure are required, on return, by the calling procedure or program. If a *single* result is required and if it is of a *standard* scalar type (i.e. integer, real, Boolean or Char) then PASCAL provides a special type of procedure called a *function.* A number of standard functions exist in the language including:

EOLN, ODD(X)	— Boolean functions
TRUNC(X), ROUND(X)	— integer functions
SIN(X), SQRT(X)	— real functions
CHR(X)	— char functions

The syntax diagram for user-defined fuctions is given in Box 6.

For other procedures, the procedure call is a complete statement consisting of the procedure identifier followed by the list of actual parameters. Since the result returned by a function is a single standard type, the function call can be made implicitly by using the function name directly in the statement within which the returned result is required. Thus

```
REPEAT
  —
  —
UNTIL EOLN
```

where EOLN represents a function call returning a result of TRUE or FALSE; and

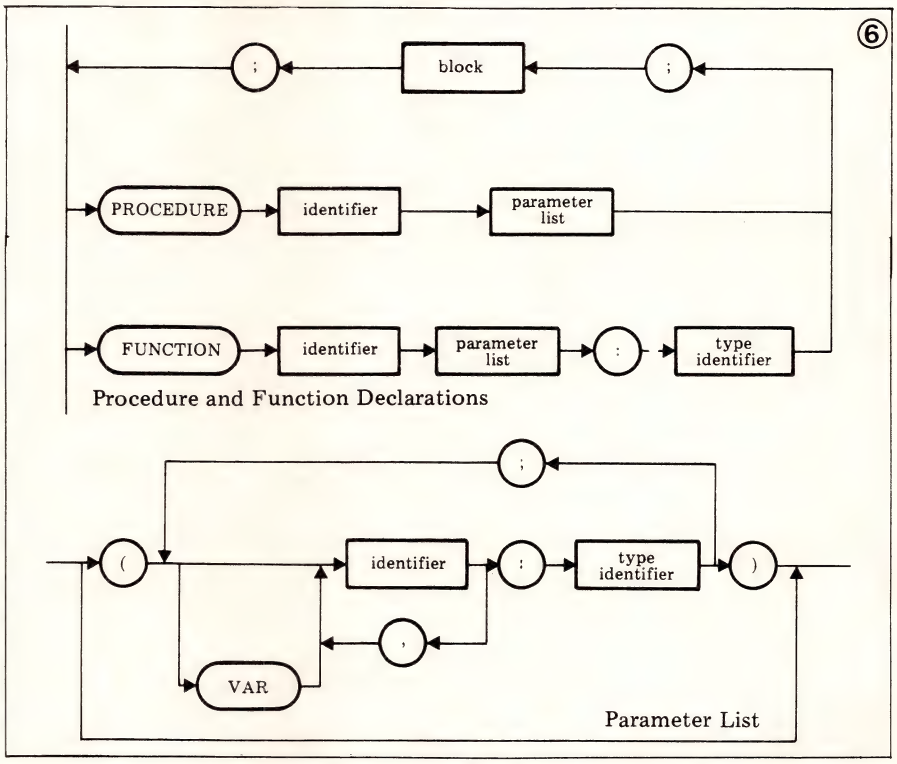
```
WRITE(SIN(X))
```

where the SIN function returns the result which is printed out. User-defined functions can be referenced in exactly the same way and the standard functions can even be overridden within a program by a user-defined function of the same name.

Compare the two segments of code in Box 5, which represent different approaches to the same task — to determine whether a given integer is even or not. When PROCEVEN isused a global Boolean variable EVEN must be declared. This is set to TRUE or FALSE within PROCEVEN depending on the nature of the indicated integer. In the second case, the *function* EVEN is set to TRUE or FALSE. This is made possible in line 17 where the function *itself* is declared as a Boolean (see also the syntax diagram in Box 6). In both cases the integer VAL is passed and in both cases an assignment is made to the identifier EVEN. This is an important feature of functions — an assignment must be made to the function identifier before control returns to the calling procedure. Finally, the concise nature of the function call (line 26) should be compared with the more unwieldly version in lines 12 and 13.

Functions, for all their attractions,

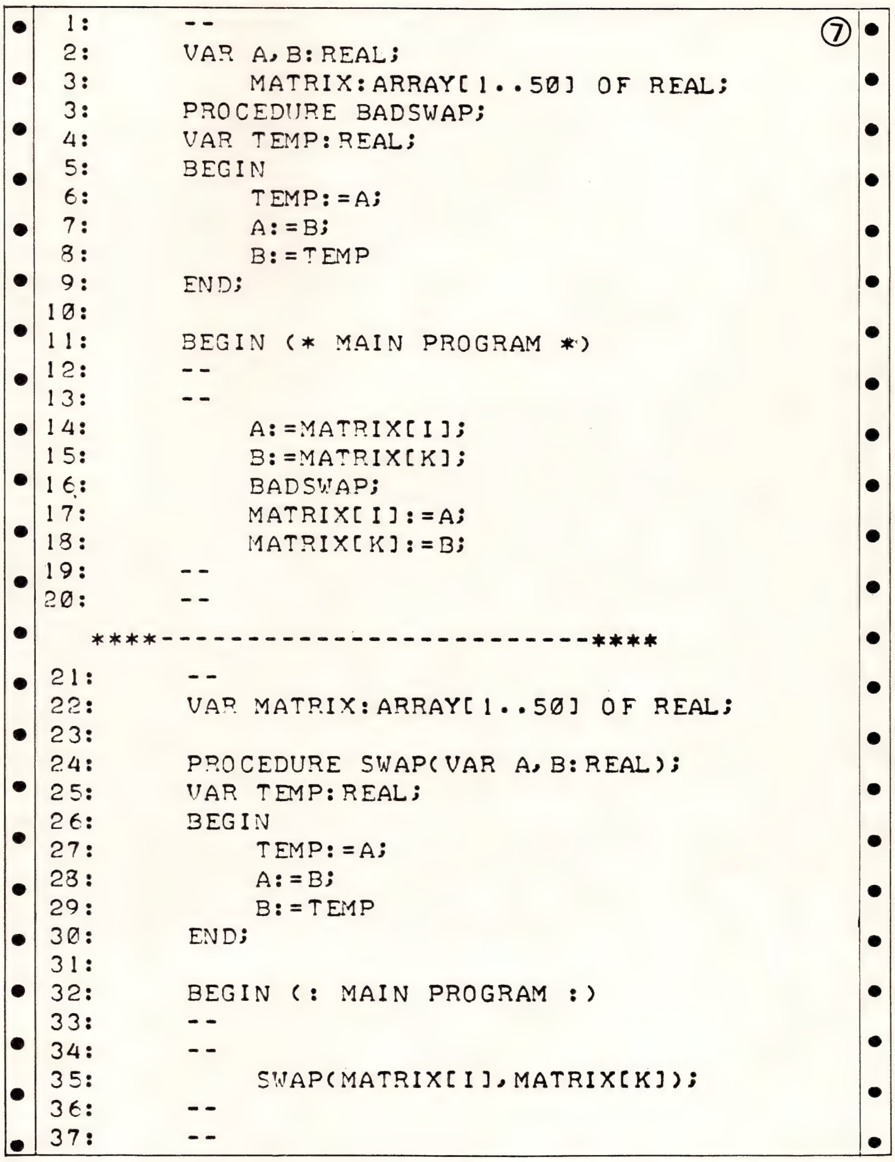
⑥



Procedure and Function Declarations

Parameter List

⑦



```
 1:      --
 2:      VAR A, B:REAL;
 3:          MATRIX:ARRAY[1..50] OF REAL;
 3:      PROCEDURE BADSWAP;
 4:      VAR TEMP:REAL;
 5:      BEGIN
 6:          TEMP:=A;
 7:          A:=B;
 8:          B:=TEMP
 9:      END;
10:
11:      BEGIN (* MAIN PROGRAM *)
12:      --
13:      --
14:          A:=MATRIX[I];
15:          B:=MATRIX[K];
16:          BADSWAP;
17:          MATRIX[I]:=A;
18:          MATRIX[K]:=B;
19:      --
20:      --
   ****----------------------------****
21:      --
22:      VAR MATRIX:ARRAY[1..50] OF REAL;
23:
24:      PROCEDURE SWAP(VAR A, B:REAL);
25:      VAR TEMP:REAL;
26:      BEGIN
27:          TEMP:=A;
28:          A:=B;
29:          B:=TEMP
30:      END;
31:
32:      BEGIN (: MAIN PROGRAM :)
33:      --
34:      --
35:          SWAP(MATRIX[I],MATRIX[K]);
36:      --
37:      --
```

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can still only return single scalar values, so PASCAL provides a different means of returning multiple scalar values on structured data types (arrays, records, etc). While the ordinary type of procedure call is employed, the call-by-value mechanism can only pass data to the procedure. A second mechanism exists whereby variables declared in the formal parameter list are marked for return to the calling procedure. The method of so marking parameters consists of preceding each variable name (or sequence of variable names) to be returned with the reserved word VAR, as shown in the syntax diagram in Box 6. These are consequently known as *variable* parameters in contrast to the *value* parameters defined in the previous section. The calling mechnism is often referred to as a *call-by-name.*

The action taken by the compiler to achieve this two-way passing of data is quite complex. Provision must be made so that references to the formal parameter in the current procedure can be connected back to the actual parameter in the stack area of the calling procedure. Although the compiler must make these arrangments, the connections are made at run-time since the compiler does not always "know" where the actual parameter is. The classic example of this circumstance occurs when the actual parameter is an array element. Which particular array element is passed depends on the array indices whose values are not known to the compiler. Before the called procedure is activated therefore, the required array element must be identified and connected with the formal parameter name at the top of the stack.

As an example of a procedure using the *call-by-name* approach, compare the two segments of code in Box 7. Both are designed to achieve the exchange (or swapping) of the values of two reals. Procedure BADSWAP achieves this by side-effect and requires two global reals A and B to be declared in the main program. If any other reals (apart from A and B) need to be swapped, then their values must be assigned to A and B before BADSWAP is called and retrieved once control has returned to the calling procedure (lines 14 to 18). In contrast, procedure SWAP contains the variable parameters A and B and any two reals in the calling procedure (lines 14 to 18). In contrast, procedure SWAP contains the variable parameters A and B and any two reals in the calling procedure can be passed and returned directly (line 35). Note that there is no reference to the variables A and B in the calling procedure declaration which implies that procedure SWAP could be inserted into any number of different programs without demanding that any external code be changed.

In this fashion it is possible for a programmer to build up a library of useful procedures which can operate independently of the calling program provided that there is a direct type correspondence between the actual and the formal parameters to avoid having to think about the precise role of each variable in the procedure. However, while this approach may be easier it is not usually more efficient due to the connection activity required to link formal and actual parameters. An exception to this condition occurs when a large data structure is required in a called procedure. The time (and space) taken in creating a fresh copy at the top of the stack will often outweigh the time lost in searching out those elements required in the procedure.

String handling

The next chapter will be concerned with the development of a text formatting program in the course of which a large amount of string manipulation is going to be required. In preparation for this program, Box 8 contains a set of functions and procedures which provide basic string handling facilities. The UCSD PASCAL system provides a similar set of functions and procedures to

Continued on page 60

8

```
PROGRAM STRINGS ;
CONST MAXLINE = 80 ;
TYPE STRING = ARRAY[1..MAXLINE] OF CHAR ;
(*VARIABLES AS NEEDED
IN THE MAIN PROGRAM*)

FUNCTION LENGTH (S:STRING) : INTEGER ;
VAR TEMP : 1..MAXLINE ;
BEGIN
    TEMP := MAXLINE ;
    WHILE S[TEMP] = ' ' DO
        TEMP := TEMP - 1 ;
    LENGTH := TEMP
END ; (*LENGTH*)

FUNCTION POSITION(PATTERN, SOURCE:STRING):INTEGER ;
VAR I, J : INTEGER ;
    FOUND : BOOLEAN ;
BEGIN
    J := 0 ;
    REPEAT
        FOUND := TRUE ;
        FOR I := 1 TO LENGTH (PATTERN) DO
           IF PATTERN[I] <> SOURCE[J+I] THEN FOUND := FALSE ;
        J := J + 1
    UNTIL FOUND OR (J>LENGTH(SOURCE)) ;
    IF FOUND THEN POSITION := J ELSE POSITION := 0
END ; (*POSITION*)

PROCEDURE STREAD (VAR S:STRING) ;
VAR I,J: 1..MAXLINE ;
BEGIN
    I := 1 ;
    REPEAT
        READ(S[I]) ;
        I := I + 1
    UNTIL EOLN ;
    FOR J := I TO MAXLINE DO
       S[J] := ' '
END ; (*STREAD*)

PROCEDURE STWRITE (S:STRING) ;
VAR I, J : 1..MAXLINE ;
BEGIN
    FOR I := 1 TO LENGTH(S) DO
       WRITE(S[I])
END ; (*STWRITE*)

PROCEDURE CONCAT(S1,S2 : STRING ; VAR DESTINATION : STRING) ;
VAR I, L1,L2:1..MAXLINE ;
BEGIN
    L1 := LENGTH (S1) ; L2 := LENGTH (S2) ;
    IF (L1 + L2) >MAXLINE
    THEN WRITELN('STRINGS TOO LONG')
    ELSE
    BEGIN
        FOR I := 1 TO L1 DO
            DESTINATION[I] := S1[I] ;
        FOR I := 1 TO L2 DO
            DESTINATION[L1 + I] := S2[I]
    END
END ;(*CONCAT*)

PROCEDURE COPY(SOURCE:STRING;VAR DESTINATION:STRING; INDEX,SIZE:INTEGER);
VAR I, J: 1..MAXLINE ;
BEGIN
    FOR I := 1 TO SIZE DO
    BEGIN
        J := INDEX + I - 1 ;
        DESTINATION[I] := SOURCE[J]
    END ;
    FOR I := SIZE + 1 TO MAXLINE DO
        DESTINATION[I] := ' '
END ; (*COPY*)

PROCEDURE DELETE (VAR DESTINATION:STRING  ; INDEX,SIZE:INTEGER) ;
VAR I : 1..MAXLINE ;
BEGIN
    FOR I := INDEX + SIZE TO LENGTH(DESTINATION) DO
    BEGIN
       DESTINATION[I-SIZE] := DESTINATION[I] ;
       DESTINATION[I] := ' '
    END
END ; (*DELETE*)

PROCEDURE INSERT(SOURCE:STRING ; VAR DESTINATION:STRING ; INDEX:INTEGER);
VAR I, SIZE : 1..MAXLINE ;
BEGIN
    SIZE :=LENGTH(SOURCE) ;
    IF SIZE + LENGTH(DESTINATION) > MAXLINE
    THEN WRITELN('STRING OVERFLOW --INSERTION NOT MADE')
    ELSE
    BEGIN
       FOR I := LENGTH(DESTINATION) DOWNTO INDEX DO
          DESTINATION[I+SIZE] := DESTINATION[I] ;
       FOR I := 1 TO SIZE DO
          DESTINATION[INDEX + (I-1)] := SOURCE[I]
     END
END ; (*INSERT*)

BEGIN (*MAIN PROGRAM*)

END .
```

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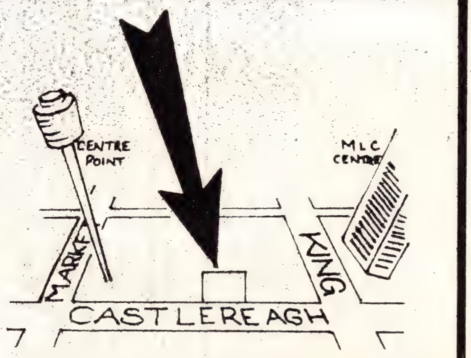
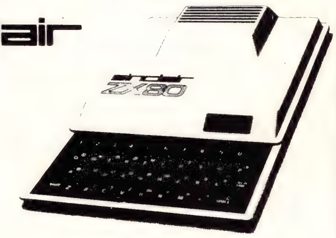


sinclair ZX80



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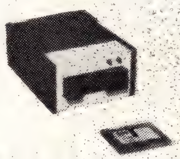

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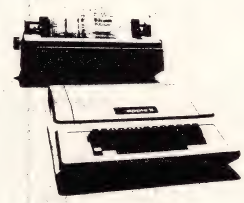

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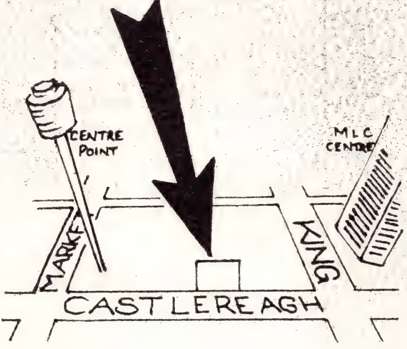

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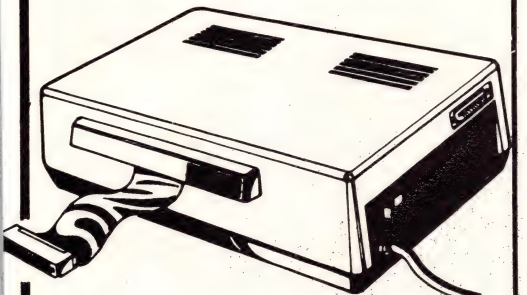

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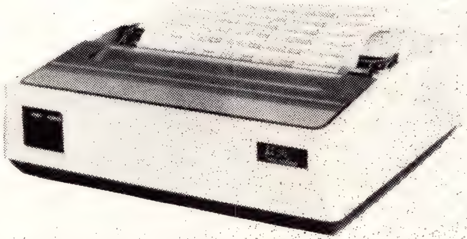

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GATEWAYS TO LOGIC

CHAPTER 3: HOW COMPUTERS THINK

Derrick Daines continues his unique guide to teaching others the basics of microcomputing.

Number sentence cubes

Time and again in computing we come across conditional jumps. So far I have confined myself to the IF A THEN B variety, but the 'A' part can and does take a wide variety of forms. An excellent aid to conditional jumps, in number work especially, is the type of dice sold under the name of Number Sentence Cubes. (See Appendix for suppliers.)

Five dice make up a usable set, although frequently two sets are sold together in one box. The plastic type is best, although wooden ones will serve quite well, especially if their edges and corners are sanded round to give a better roll. Readers will find different ways to use them, but my method is as follows:

The five dice are rolled together and then sorted to make a sensible number sentence. One number die begins the number sentence; next there's an operations die that has its faces printed with the four operations symbols +, —, x and ÷. Another number die follows and then the one that we are particularly interested in, the resultant die. Finally another number die finishes off the sentence.

Notice that although the sentence may or may not be true, it does make sense — it is understandable.

The resultant die has its six faces inscribed as follows:

= (is equal to)
≠ (is not equal to)
> (is greater than)
≯ (is not greater than)
< (is less than)
≮ (is not less than)

The student copies down the number sentence and then has to decide whether it is true or false, writing the appropriate word after it. Unfortunately for teachers, this exercise is difficult to mark. Obviously there's no answer book to work from and having done the first 10 or 12 — continually asking oneself questions like, "Is it correct that that statement is false?" — one begins to tick things that should have been marked wrong, and vice-versa. Luckily, a great deal of practice is not normally necessary. Twenty or thirty examples are usually sufficient for anyone (Fig 1).

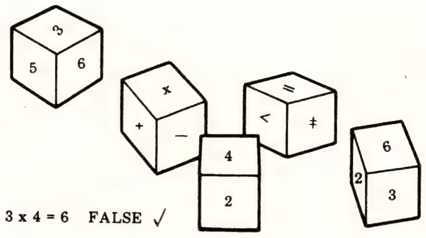


Fig 1 NUMBER SENTENCE CUBES

Other conditional jumps are sometimes encountered, and the teacher may wish to adapt a spare dice for them:

⩾ (is greater than or equal to)
≱ (is not greater than or equal to)
⩽ (is less than or equal to)
≰ (is not less than or equal to)
≈ (is equivalent to)

One manufacturer supplies his number sentence cubes with 'empty set' symbols, △ and □ , which can be used in the following ways. (i) A special value is set aside for each, such as ½, 50, 100, zero, infinity; (ii) two or three times the next roll, (iii) the next roll is negative, (iv) the student may freely choose any number, (v) the number is unknown.

Every computer program save only the very simplest contains numerous examples of conditional jumps, and readers may rest assured that the practice I've outlined is well worth the time and effort devoted to it. For examples of conditional jumps, the reader might like to turn to Figs 2, 6, 9 and 10.

Hexadecimal

It's a simple fact that when a human being works in binary (0s and 1s), (s)he is very prone to error. However, the computer can only work in binary . . . the first computers relied entirely on an input of binary, and also gave out only binary. Not only was this error-prone, it was also excrutiatingly slow to execute. Early 'Computer Man' needed some method of working that would cut down on human error and if possible speed up the operation of putting binary information into the computer. Various methods have been tried over the years, but of all these middle-level computer languages (as they are called), hexadecimal seems to have gained the most adherents — particularly following the advent of the relatively cheap home computer. The reasons are worth going into.

A computer word in binary comprises a certain number of bits. This is the number of binary bits that the computer can hold in any one memory. In large (or 'main frame') computers, a memory may hold 16, or even 32, bits; for home computers this is quite excessive . . . they don't normally need to handle numbers of that size or accuracy and on the odd occasion that they do, the work can still be carried out at the expense of a little time. Some home computers use a four-bit word, but the majority use 8. For the time being, we'll take an 8-bit word as standard.

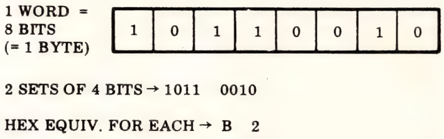


Fig 2 BINARY TO HEX

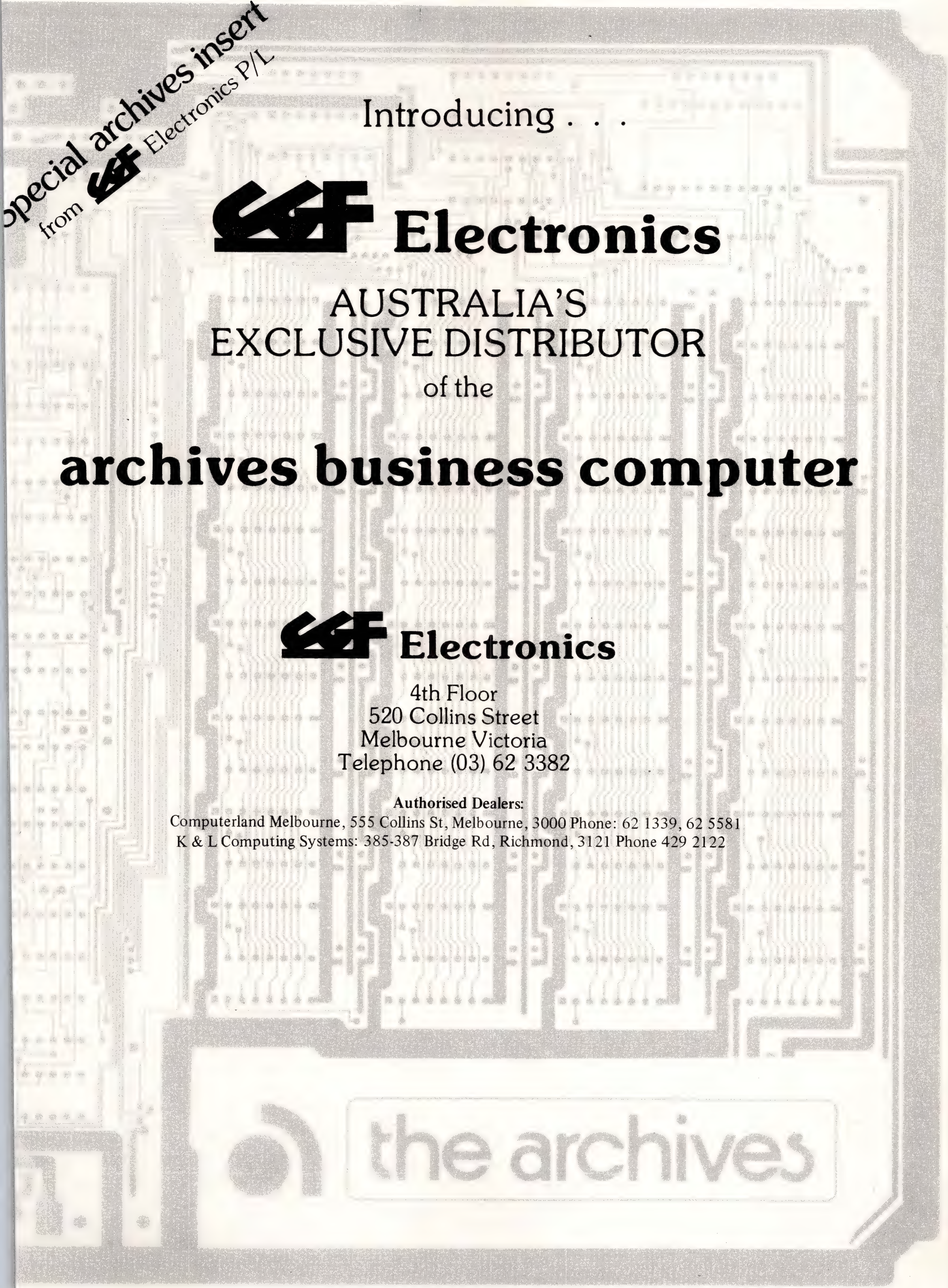
For convenience, the 8 bits can be divided into 2 lots of 4 bits each (Fig 2). The decimal value of four binary bits ranges from 0 to 15, which is sufficiently close to our normal 'tens' counting as to be very interesting. We can use the symbols 0 - 9 to start off with and then invent or adapt other symbols for the remaining 6. For economic reasons it's better to adopt other symbols without adaptation and so it has come about that we use the capital letters A — F. Now by using the range of symbols 0 — F, we have an easy and convenient notation for counting up to 15 (Table 1). By using two such symbols — one for each set of four — the eight binary digits are reduced to manageable proportions. Which would you rather type in . . . 10110111 or B7?

In devices that use the hexadecimal input method, there's a clever little silicon chip that converts the hex into binary form, so don't let a hex input blind you to the fact that the microprocessor is still working in binary output from the micro into hex for the human to read.

Children in particular grasp the idea very quickly — even at the age of 8 or 9.

HEX	DECIMAL	BINARY
1	1	1
2	2	10
3	3	11
4	4	100
5	5	101
6	6	110
7	7	111
8	8	1000
9	9	1001
A	10	1010
B	11	1011
C	12	1100
D	13	1101
E	14	1110
F	15	1111

TABLE 1



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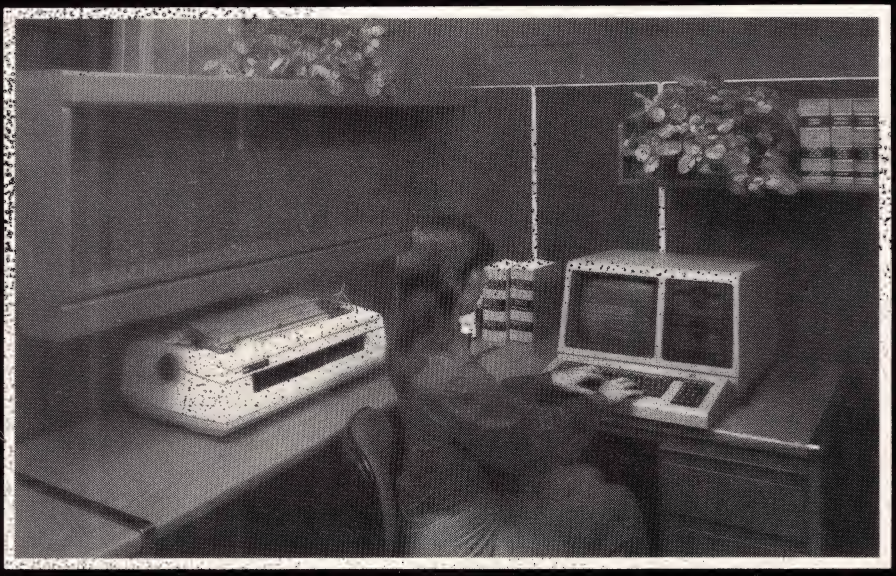

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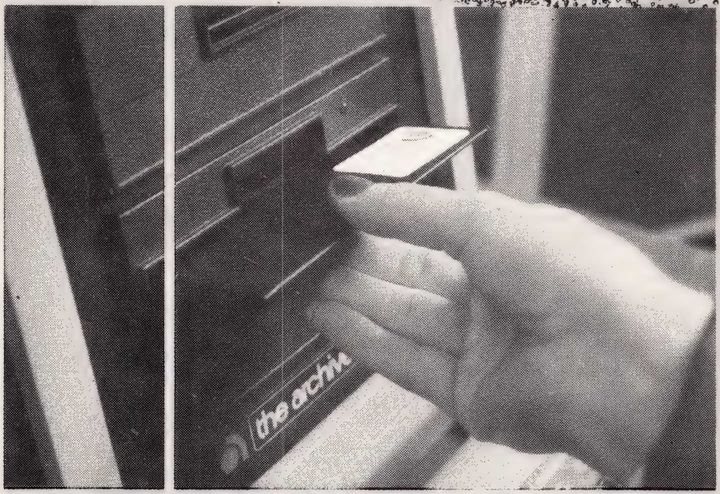

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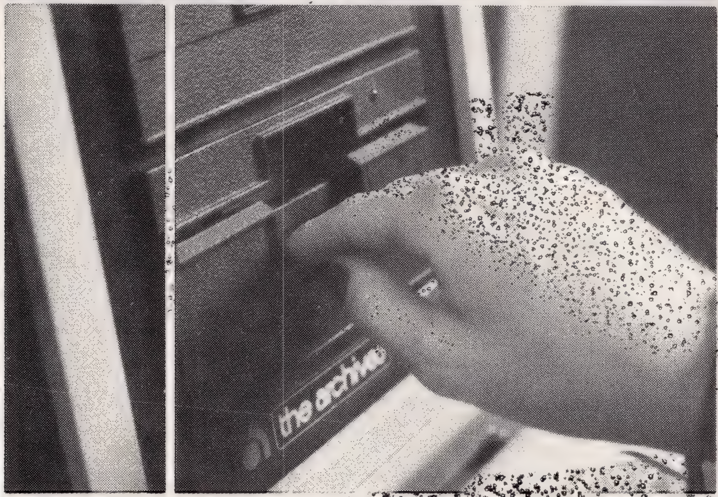
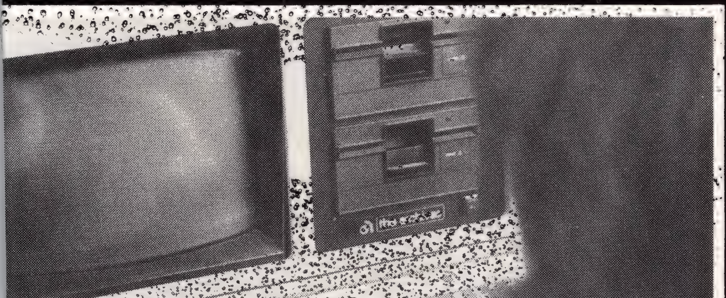
Now depress the letter "B" to activate the program. Step by step The Archives will lead you through the file.



The Archives keyboard is virtually the same as a typewriter. When using The Archives as a word processor, you may type continuously without using the return key as The Archives will automatically justify the words on each line.

Once you have completed your business letter, contract or proposal simply depress "Save and Done" and The Archives will transfer your document from the system's internal storage to the disk you have inserted.

System Operations



You may return to that document at a later date to edit or change the contents. Your letter is to Mr. Jones and you wish to print the same letter to Mr. Smith, you need not re-type the letter—instruct The Archives to change Mr. Jones to Mr. Smith wherever it appears—it will do so automatically.

The simplicity of operating the Archives system will convince you that an Archives Business Information System is well worth your investment.
You do not need expensive and lengthy operator training to have The Archives system work for you. If you can type—then you can use The Archives. If you have a business then you need The Archives. The Business Information System of tomorrow is here today.

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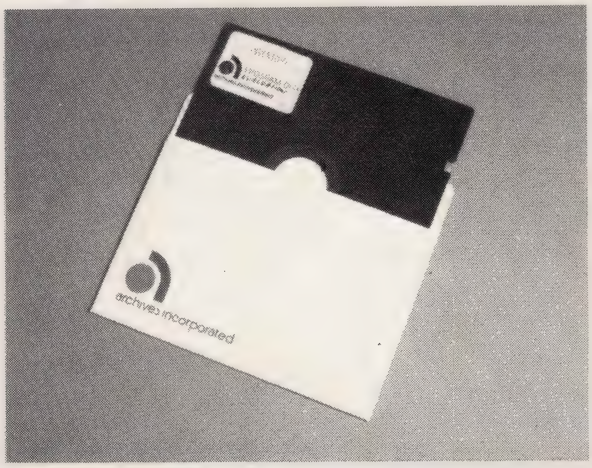

SOFTWARE

Standard
- Archives 2K Monitor
- CP/M™ Operating System

Optional
- Word Processing
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- Payroll
- CPA Client Accounting
- Property Management
- Inventory Management
- Work in Process Inventory
- Legal Billing
- Mailing List
- Data Base Management
- Microsoft™ Basic
- CBASIC 2 ™
- Microsoft™ Fortran
- Microsoft™ Cobol

SOFTWARE

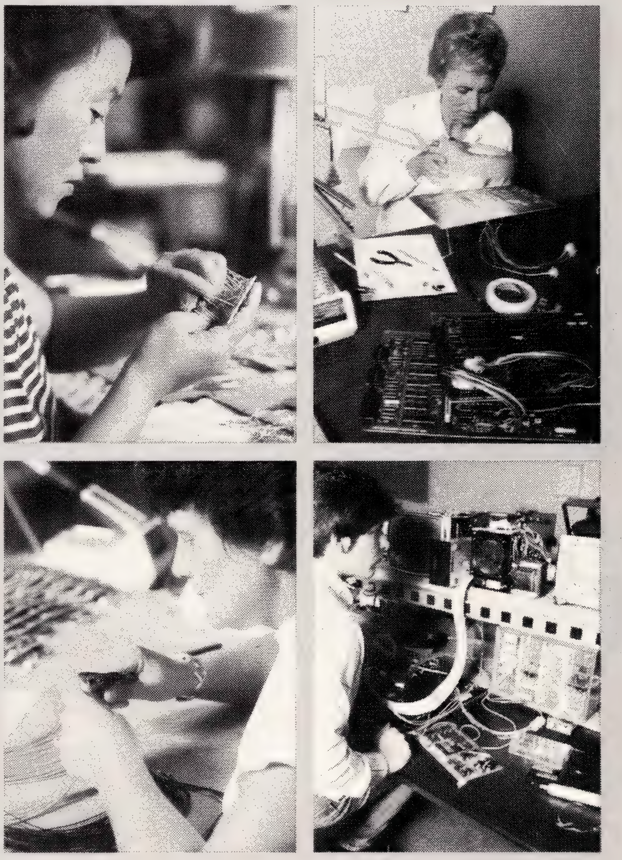
Our system gives you the utmost of versatility through the use of many software packages plus commercially oriented telecommunications files which are transmitt over standard telephone lines. With this communications feature, you now have "big computer" capabilities because The Archives can communicate with other systems providing unlimited access and retrieval. Make the comparison and you will find that The Archives is the system for you.

HARDWARE

Processor	• Z-80A at full 4 MHZ
Bus Structure	• S-100
Disk Storage	• Dual 77-track drives, single sided • 5¼" disk, soft sectored • 372K bytes formatted per drive • Optional—dual double sided drives over 744K bytes formatted per drive • Optional—10M byte Hard Disk/5M byte Fixed and 5M byte removable
Display	• 12" Green phosphor Monitor • 25 lines x 80 Characters • 240 x 100 Graphics format • Memory mapped video • Screen attributes including inverse, video blink and underline in any of 8 intensities • non-glare filtered screen
Keyboard	• Detachable microprocessor keyboard • 104 Keys • Lefthand function keycluster • Righthand numeric keycluster • 23 relegendable function keys
I/0	• Both serial and parallel
Options	• Direct wire modem • HZ Emulator

Physical Characteristics

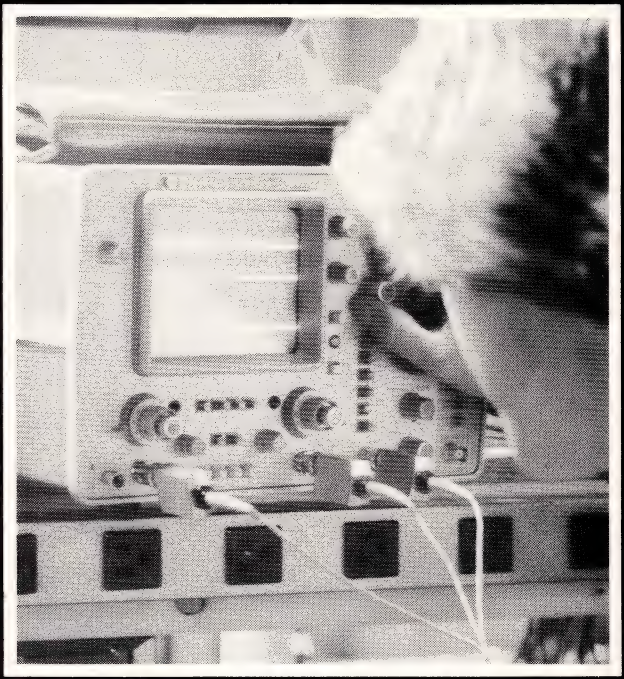
Main Unit	13.5"H x 17"D x 22"W
Keyboard	2.8"H x 8.6"D x 20.6"W
Weight	59 pounds
Electrical	110/220V 50/60 HZ



Hardware

Now that you know the advantages of The Archives, you should also know that The Archives is designed and built by experience and expertise—two factors that are making Archives Incorporated famous throughout the world.

Superb styling, solid dependable construction and realistic price are highest priority at Archives. You also get the advantage of Archives depot maintenance, our complete factory inventory of back-up support, and a maintenance team of factory representatives and dealer network. Archives Incorporated is ready to keep your system in peak condition and assure you of professional maintenance and materials if ever it's required.



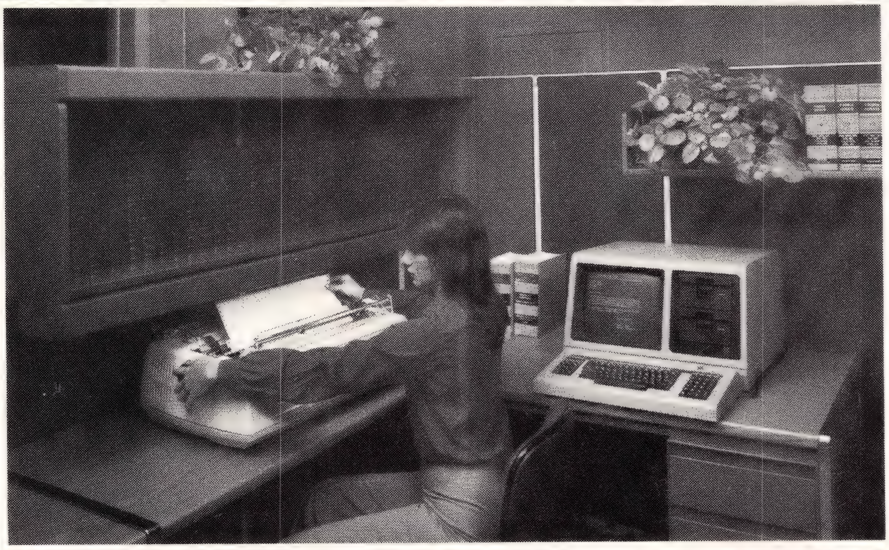
archives incorporated

Archives Incorporated views the management of information as the dominant aspect of a computer's function. Our engineers designed The Archives based on that concept. In order to effectively manage information using a computer—the computer must be capable of being managed. Built to the scale of a human being, not a corporation, The Archives is a system easy to use, easy to understand and easy to maintain. It's a computer a person can operate without being a computer expert.

Personalized service is also a high priority with Archives Incorporated. It has made us what we are today, and it will enable us to continue to grow in the expanding computer industry.

In the future, Archives Incorporated will continue to enhance its product, to maintain the excellence of quality already developed and recognized throughout the industry, and to provide a product economically priced. We will continue to offer more software packages to assist the user in utilizing The Archives™ to its maximum potential.

Engineerin



There is no question that the major area restricting your business growth is in the office. This is one place where employee efficiency is still in the dark ages—requiring the handling of paper, forms and files. What you really need is not the physical presence of obsolete forms and letters but the information and data they contain. You need The Archives Business Computer.

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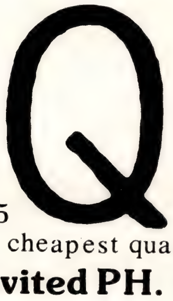

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HEXADECIMAL CONVERSION TABLE

HEX COLUMNS											
6		5		4		3		2		1	
HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC
1	1048576	1	65536	1	4096	1	256	1	16	1	1
2	2097152	2	131072	2	8192	2	512	2	32	2	2
3	3145728	3	196608	3	12288	3	768	3	48	3	3
4	4194304	4	262144	4	16384	4	1024	4	64	4	4
5	5242880	5	327680	5	20480	5	1280	5	80	5	5
6	6291456	6	393216	6	24576	6	1536	6	96	6	6
7	7340032	7	458752	7	28672	7	1792	7	112	7	7
8	8388608	8	524288	8	32768	8	2048	8	128	8	8
9	9437184	9	589824	9	36864	9	2304	9	144	9	9
A	10485760	A	655360	A	40960	A	2560	A	160	A	10
B	11534336	B	720896	B	45056	B	2816	B	176	B	11
C	12582912	C	786432	C	49152	C	3072	C	192	C	12
D	13631488	D	851968	D	53248	D	3328	D	208	D	13
E	14680064	E	917504	E	54344	E	3584	E	224	E	14
F	15728640	F	983040	F	61440	F	3840	F	240	F	15

Table 2

There is one reservation people have about hex, however. "If we're counting in 16s," they ask, "why is it that we haven't got 16 numbers?"

"Oh — haven't we?"

"No. We go up to 9, then A, B, C, D, E, F — that's 15."

"What about 0?" I ask

A puzzled frown crosses the face and they go away to count all over again.

I hear the same thing for binary. "We're counting in 2's, so why can't we use a 2?"

If such a misunderstanding has arisen, the solution lies in pointing out that although we talk about counting in tens, we have no special symbol for the value ten. We use a 1 in the next column and a 0. People forget that zero has a place value, even though it has no numeric value.

It's worth devoting considerable practice to converting decimal to hex and vice-versa before going on to addition and subtraction. It's best not to use this sort of 'hand' work on numbers above 50 or so; for them, Table 2 should help.

Decimal to Hex conversion

Find the number on the table that is the highest possible but is not greater than the decimal number to be converted. Note its hex equivalent. Find the remainder and continue in the same fashion.

For example, to change 3600 to hex, the largest number on the Table less than this is 3584, hex value E. The remainder (3600 — 3584) is 16, hex value 1 in the second column. There's no remainder, so we put a place holder 0 in the last column. The hex value of 3600 is E10.

To change 9999 to hex — the largest number less than 9999 is 8192, hex value 2 in the fourth column; the remainder is 1807. The largest number less than this is 1792 in the third column, hex value 7; the reminder 15. This is worth hex F in the last column. Since we have had no value from the second column, we insert a 0 place holder. The hex value of 9999 is 270F.

Hex to Decimal conversion

Find each hex digit in the appropriate column and add together their decimal equivalents.

For example, to change 4A0F to decimal, we look up the value of the 4, (16384), the A (2560) and the F (15) in the appropriate columns, and add them together to make 18959.

Flowcharts

A flowchart consists of a series of boxes — instructions and condition tests — linked by arrows in such a way that following it leads inevitably to the correct outcome. Note the word 'inevitably'. A flowchart must be free of ambiguity and have no room for error of any kind if it is to work properly. The attainment of this aim is not necessarily as easy as it might seem at first sight. Most computer programs are drawn out in flowchart form first and even then it's astonishing how even the most experienced programmer will find unforeseen and unwanted results occurring when the program is run.

For most students, a good start is to flowchart a well-understood and familiar sequence of events — such as getting up in the morning, getting a book out of the library, or making a cup of tea. (Fig 3). As the chart is developed, the students' suggestions can be guided by such leading questions as, "What if I don't want sugar?" or "Who likes cold tea?" This process can continue until the teacher is satisfied that the flowchart is detailed enough.

It's a fact quickly determined by experiment that any flowchart can be made more and more detailed — a process that can continue almost ad infinitum. Judgement is therefore needed to determine the optimum amount of detail in a flowchart, but as a rule of thumb it's wise to assume that too much is better than too little. For tuition purposes, even the simplest flowcharts should contain at least one each of the differently-shaped boxes of Figures 4 and 5.

Having created a sample flowchart, students should be urged to create their own. Plastic stencils available are simple and cheap and will

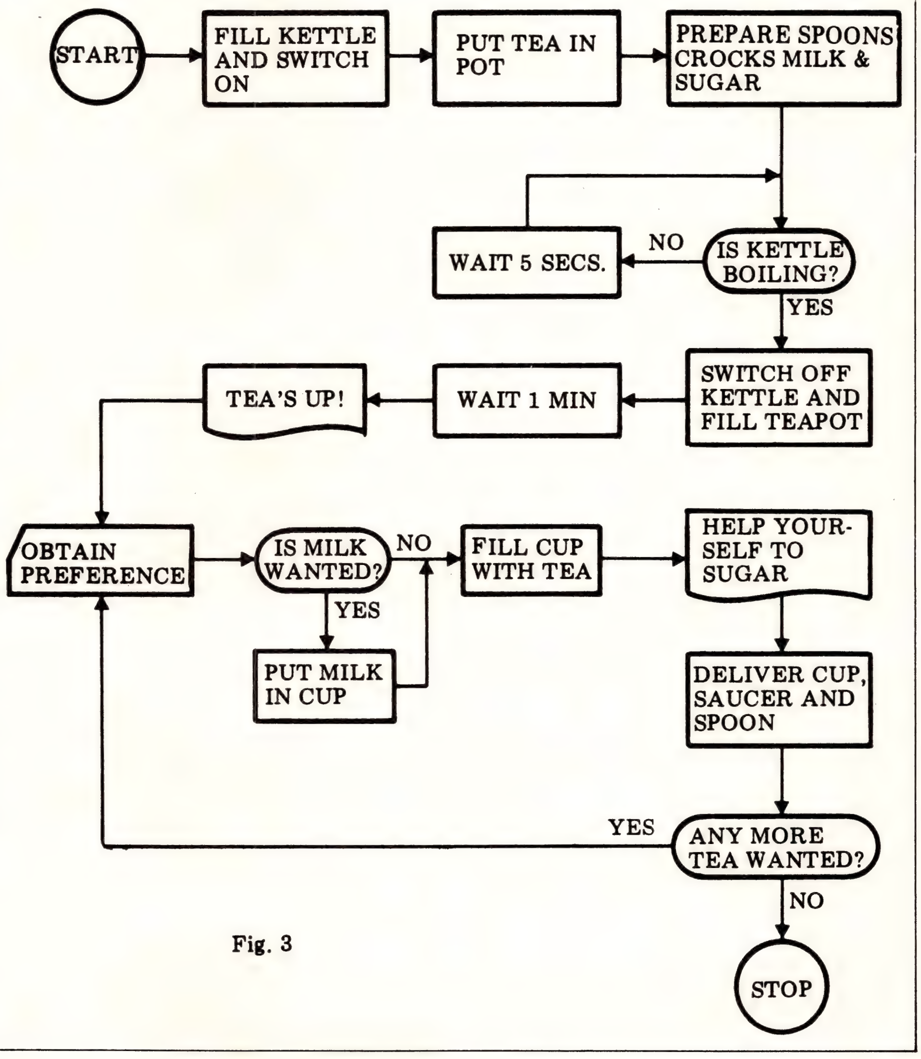

Fig. 3

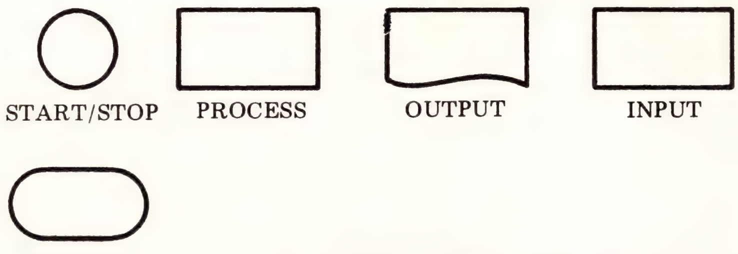

Fig 4 BASIC FLOWCHART SYMBOLS

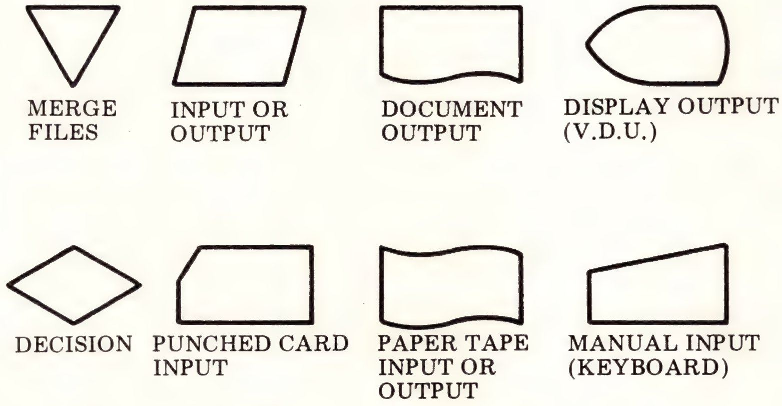

Fig 5 ADDITIONS AND ALTERNATIVES

serve admirably — providing supplies remain available. As a last resort card stencils may be made very cheaply.

If a flowchart is to be displayed, it's worth using a different colour of paper for each box shape — thus an output could be blue, a input red, and so on. When the boxes are stuck down onto a white backing sheet with arrows drawn in black felt-tip, the result can be most pleasing.

Many books on computing carry good flowcharting examples. The example given in Fig. 6 deals with airline bookings.

Fred

FRED is an acronym for Family Robot Electronic Device in my school and the children love him. I ask for a volunteer to play the part of Fred and try to pick someone with a good intelligence and a lively sense of fun. I tell the class that FRED is a robot and it's their task to instruct or program him to execute a simple task such as standing on a chair placed some distance away, finding and picking up a pencil — and so on. To the child playing the part of Fred we say that he must be pernickety about the instructions that he obeys. He must take nothing for granted, nothing as understood, and must obey every instruction implicitly. If I've chosen wisely, the child's antics and deliberate misunderstandings will teach more about the difficulties and limitations of technological design than a whole year of lessons.

One last thing; I find it a good plan to tell Fred to buzz loudly when he fails to understand an instruction. Also, instructions not preceeded by the 'call to attention' signal, "Fred" are to be totally ignored.

Here, by way of an example, is a distillation of many such lessons; in one or two places I've added interesting points that were discussed later. I've labelled the instructor CHILD, but of course I aim at getting contributions from all and sundry. As you may imagine, the following will have been interspersed at times with quite heated arguments between pupils and between pupils and Fred.

CHILD: Move forward.

FRED does nothing.

TEACHER: You've forgotten the call to attention.

(The call to attention is a kind of switch to filter out all unwanted instruction, extraneous noise and so on.)

CHILD: Fred — move forward.

FRED: Buzzzzz.

(A multitude of reactions can be programmed into a machine to indicate faults. Sometimes the type of signal indicates the type of fault, a technique that can lead to computers printing out details of where and what the fault is, or even to self-repair — see later.)

CHILD: Fred — put one foot forward.

FRED: Buzzzzz.

(Still too general. Fred has got two feet.)

CHILD: Fred — move your left foot forward.

FRED: Buzzzzzz.

CHILD: Fred — move your left foot forward a little bit.

FRED sways slightly

CHILD: Sir — he's being awkward!

TEACHER: Not at all — he's doing exactly what I told him to do. He also did what you told him to do, didn't you, Fred?

FRED: Yes sir — I moved it one millimetre.

CHILD (grimly): Move your left foot forward six inches.

TEACHER: You've forgotten again.

CHILD: Oh! — Fred — move your left foot six inches. Blimey — now he's gone and moved backwards!

(Instructions must be precise and unequivocal at all times. Obviously, the game becomes a battle of wits between Fred and the rest of the class, but they are learning some important lessons. More and more machines are being designed with a fail-safe mode of operation. Simply put this means that, in the event of ambiguity, the machine will adopt one particular mode of operation that the designer considered to be the safest. Usually this is interpreted as doing nothing.)

CHILD: Step on the chair. Er — sorry. Fred — step on the chair.

(Newcomers to computing and other forms of artificial intelligence are frequently to be observed apologising to machines. This is probably a confusion between intelligence and sentience, allied to a sort of personality that all machinery exhibits to a greater or lesser extent.)

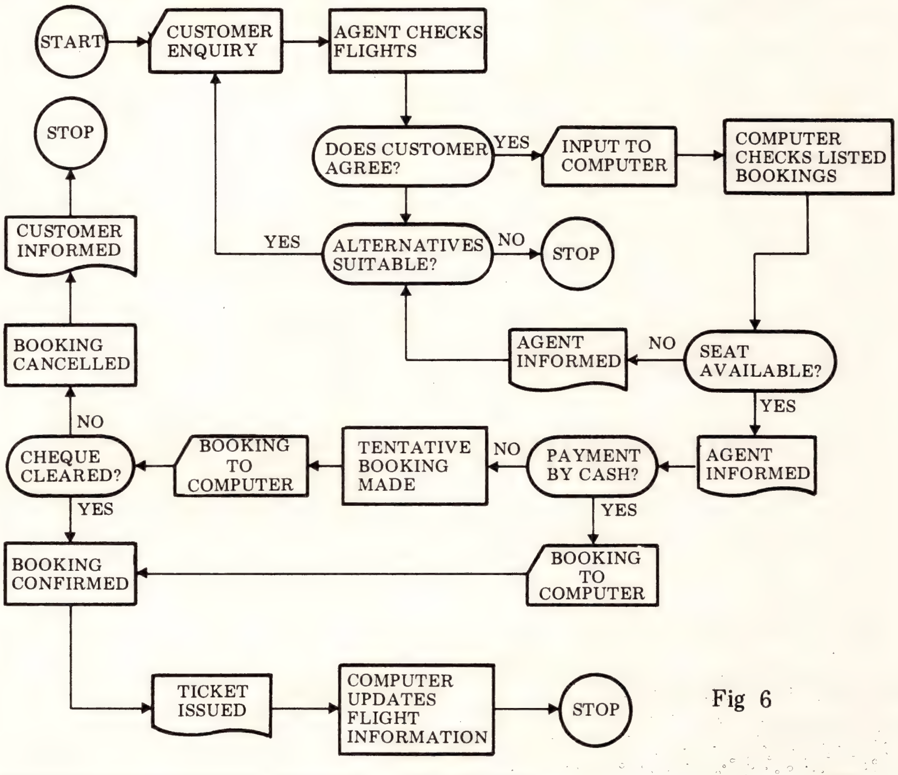

Fig 6

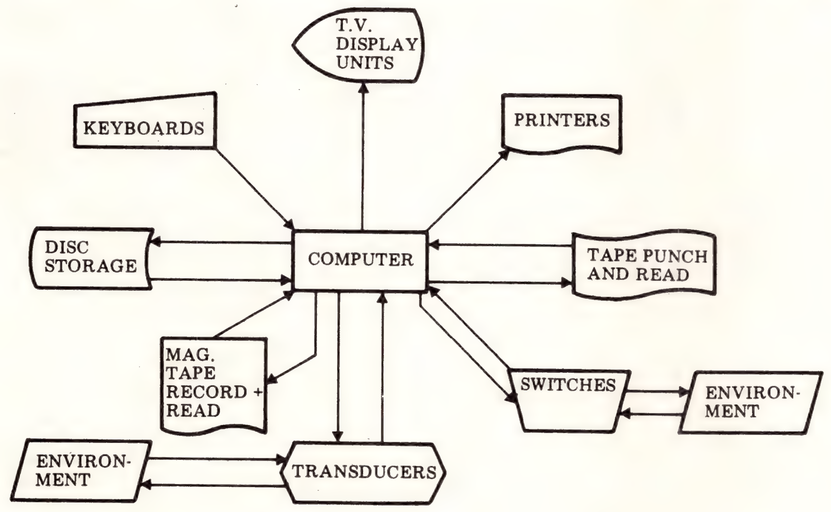

Fig 7

FRED does nothing.

TEACHER: Tell them what's the matter, Fred.

FRED: I'm thick, sir. I don't know what a chair is.

(A good point. Getting the computer to recognise simple objects has been very difficult, whilst recognising more complicated things — such as a particular person's handwriting — has so far proved to be impossible.)

CHILD: It's that thing there in front of you, fathead.

TEACHER (cutting argument): I think we'll accept that for now. Let's say Fred, that you've been programmed to recognise a chair.

CHILD: Step — whoops! — Fred, step up on the chair.

FRED: Buzzzzz.

TEACHER: You'll have to do it bit by bit. He doesn't know how to step up until you've programmed him.

CHILD: Raise your right foot eighteen inches.

FRED does nothing, grinning broadly.

CHILD: Fred — raise your right foot eighteen inches.

FRED falls over with a clatter.

(The action of walking is extraordinarily complicated, involving inter alia the transfer of weight from one side to the other. It's for this reason extremely unlikely that humanoids will ever become a reality except perhaps in research prototypes. It's far more economic to devise other methods of locomotion and, for instance, robotic machines may well end up being tripedal.)

CHILD: Fred — get up.

FRED: Buzzzzz.

(The chaos ensuing is better imagined than described since the act of rising to an upright position is even more complicated than walking. It seems likely that computers and robotic machines will always require the intervention of a human agency at some time or other, for the simple reason that every possible contingency cannot be foreseen and/or catered for — unless the application is relatively simple. The more versatile a machine is then, by a curious paradox, the more likely it is to break down . . . or to find itself in situations with which it cannot cope.)

Later, when Fred has regained an upright position:

CHILD: Fred — raise your right foot eighteen inches.

FRED does so.

CHILD: Fred — put your right

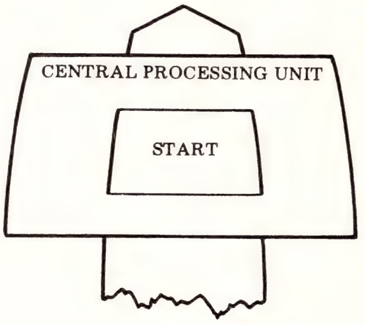

Fig 8

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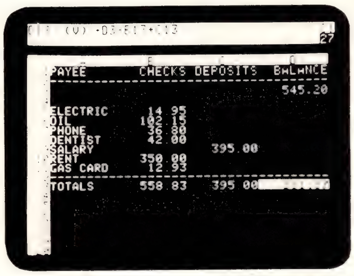

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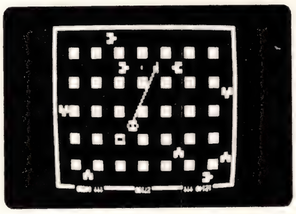

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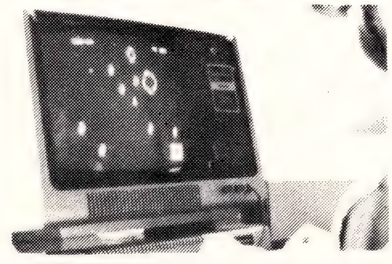

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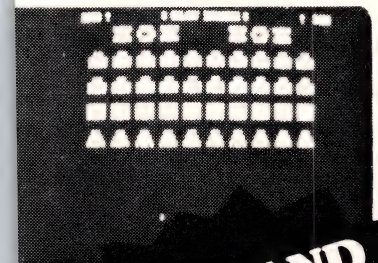

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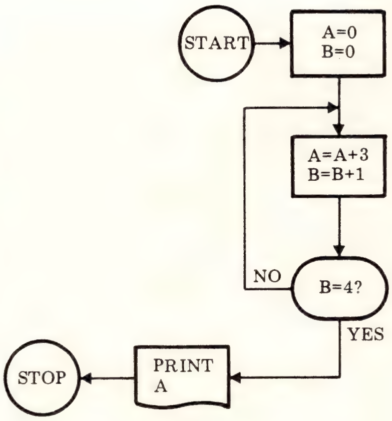


Fig 9

foot down on the chair.

FRED: Buzzzzzz.

TEACHER: Do it bit by bit.

CHILD: All right Fred — put your right foot forward — er — twelve inches.

FRED does so.

CHILD: Fred — lower your right foot onto the chair

FRED does so

CHILD: Fred — hell, he's trodden on my pencil!

(Another reason why robots are not likely to be humanoid. Ensuring the safety of the machine means that all working space must be kept clear and it's best if the machine itself sweeps the area around it. This is not easy with bipedal machines. An alternative is to incorporate a fail-safe device that sounds an alarm if an obstruction is encountered — a solution that brings problems in its wake of determining the difference between an obstacle and a lawful part of the environment. Keen followers of the ABC's 'Doctor Who' series will have observed that K9 must always operate on a smooth floor area, although very often the cameras are trained above the floor to disguise this fact.)

An alternative instance:

CHILD: Fred — put your foot — er — right foot forward nine inches.

FRED does so.

CHILD: Fred — lower your foot until it reaches the chair seat.

(Better. An instruction to "lower your right foot nine inches" could result either in Fred not lowering his foot far enough — hence necessitating more instructions — or else forcing his foot down the full nine inches to either destroy whatever he is putting his foot on, or more likely, tipping himself over backwards. However, there's another teaching point to be made here . . . as follows.)

TEACHER: Fred — lower your right foot one inch.

```
1. START
2. LET A = 0
3. LET B = 0
4. LET A=A+3
5. LET B=B+1
6. IF B≠4 THEN GO TO 4
7. PRINT CONTENTS OF A
8. STOP
```

Fig. 10

FRED does so.

TEACHER: Fred — has your right foot encountered a solid surface?

FRED: No sir.

TEACHER: Fred — lower your right foot one inch.

FRED does so.

TEACHER: Fred — has your right foot encountered a solid surface?

(This is known as a reiteration loop — a very powerful tool in the hands of the programmer since it results in a great saving of instructions. The slight cost is the conditional test which offers the machine its only way out of the loop. Conditional tests have already been met in connection with number sentence cubes. Here the important point is being made that tests can be carried out on anything within the environment of the machine or on any condition existing within the machine itself — analogous to the feeling of hunger in the human.)

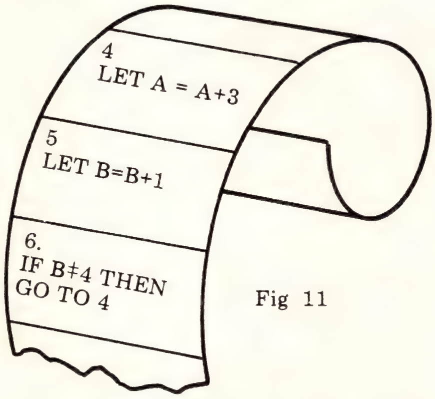


Fig 11

Probably enough has been written about this particular exercise to demonstrate a number of points.

(1) The lesson provides rich information on robots; in addition it dispels many of the myths that, generated by writers of science fiction, continue to be perpetuated by films and television.

(2) From robots in particular we may draw lessons about all artificial intelligence and all machines in general — whether electronic, mechanical or a combination of both.

(3) Flowcharting is still further understood since we can draw flowcharts incorporating the successful instructions.

(4) Students are better able to understand the step-by-excruciating-step nature of computer and robotic instructions. They begin to ask the question, "What can go wrong?" Remember Murphy's Law — what can go wrong, will.

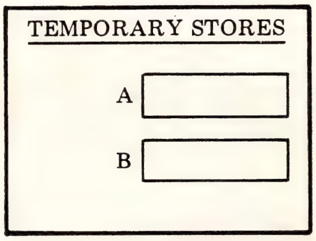


Fig 12

Do-while

Because of the lightning-fast speed at which computers function, most of their operating time is simply wasted. For example, it's common for the computer to have finished a computation and be ready with the answer before the human operator has removed his/her finger from the GO button. Time is wasted (a) because of the relatively slow print-out of results and (b) because of the extremely long delay (so far as the machine is concerned) before the human requires to make any further computation. This last delay can range from seconds to perhaps days, but of course in computer terms even a second is a very long time. When a

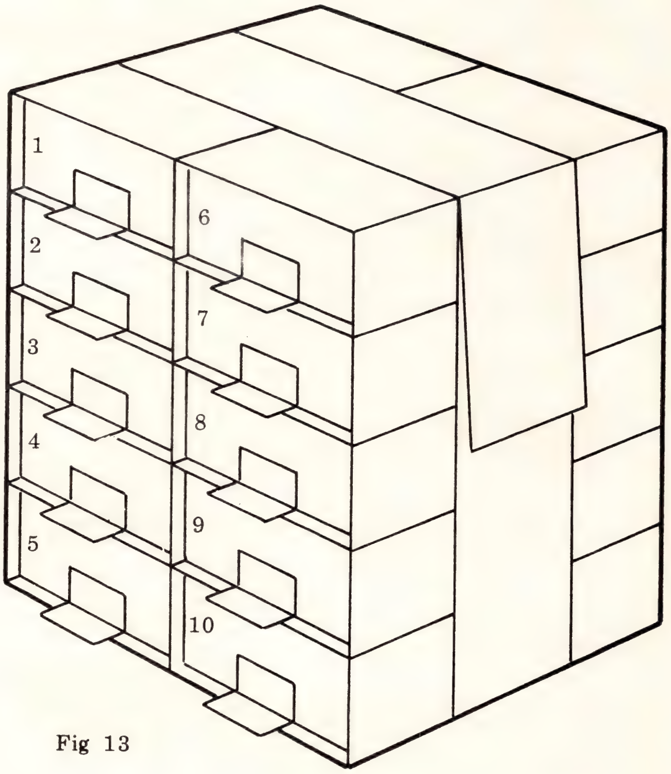


Fig 13

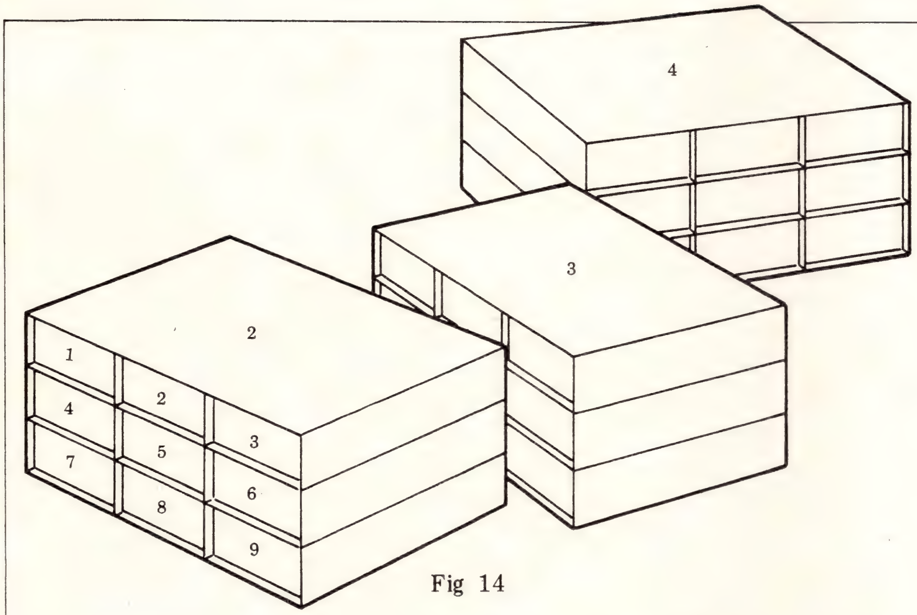


Fig 14

computer is capable of making a million operations a second, there isn't much point in having it hanging around doing nothing.

The answer lies in giving the computer more to do. Some computers can, with the addition of a little hardware, be utilised by four or more people at once, or be engaged in a long printout between bouts of game-playing with the operator. The point can be made by means of a little play. In school I pick the brightest and nippiest child to be 'the messenger' and arrange for four or more other children to play the part of stupid giants; they have the task of writing to each other via the nippy messenger.

The giants must write in their very best handwriting and rather slowly, but their notes may be as brief as they wish. Verbal communication is forbidden. The sort of note that's suitable is, "What did you watch on television last night?" to which the first might reply, "I watched Match of the Day. What did you see?"

Desks may be arranged so that the messenger is in the centre of a square. (S)he buzzes about actively, looking for a message to deliver. As soon as one arrives it's delivered to its destination — and the messenger continues his/her search. If two stopwatches are available, it's useful to have onlookers check the time spent in actually delivering messages in comparison with the time spent in looking for another message to deliver.

1	2	3
4	5	6
7	8	9

Fig 15

A variation of this play is for the teacher to increase the number of slow stupid giants. A rule is made that no-one may write a second note until they have received a reply to their first. The result will be that the poor messenger never stops running and the giants may begin to wait some time for replies. This gives the opportunity to introduce two other concepts — queuing and priority interrupts. Queuing is already well understood. Priority interrupts can be illustrated by having one child, chosen for top priority, who is permitted to bawl out, "Message!" whenever (s)he has one for delivery. The messenger must complete the task at hand — then go and fetch the priority message.

It's important the teacher points out that the play is a model of computer operation slowed down millions of times, so that although a giant may have to wait, say, five minutes between messages, in real terms a computer user should not have to wait more than a millisecond — even if the computer is overloaded.

Readers with experience of computers may protest that they have had to wait for considerably longer than a fraction of a second, but of course this is because priority users have given the computer not one but many millions of operations to perform. Further, in practice there are often many levels of priority, with top priority going to those matters dealing with the safety of the machine itself and its installation, second priority going to housekeeping matters and maintenance of programs, third priority going to extremely urgent programs, fourth to not-so-urgent programs and so on, down to eighth, ninth or tenth priority. Seen in these terms, the delay is understandable.

The analogy between the play and Figure 7 is clear. The slow giants are the peripheral devices, while the nippy messenger is the computer itself — or more precisely, that part of it called the Central Processing Unit. Other plays of this type may be devised to emulate various functions of the computer and a good source of ideas is "Computer Science — a First Course", a slim volume obtainable from the Open University Press.

Cardboard computer

There are various models of computer operation and this one is as good as any. Give students each a sheet of cardboard some 6″ square and have them cut two parallel slots (Fig 8). The name Central Processing Unit is printed boldly across the top and then, if they feel like adding a little realism, the cards can be decorated with rivets, nuts, bolts, handles and dials. Each student is then given a strip of adding-machine paper, about a yard long, which is threaded through the slots so that only an inch or so of paper is revealed at any one time. Draw lines on the paper, top and bottom of the frame, and then pull the paper up so that the bottom line is now at the top. Draw another bottom line. Repeat in this way until all the strip of paper has been marked off in standard-size frames. Pull back to the beginning.

This first step may have seemed superfluous, but experience has shown it to be very desirable; frames drawn at the same time as they are written often turn out to be non-standard in size . . . leading to great confusion later.

The flowchart of Figure 9 can now be displayed and discussed. It could hardly be simpler for it just multiplies 3 x 4 using the technique mentioned earlier of repeat addition. The next step is to translate the flowchart into a listing, as per Figure 10; the students should copy this onto their strips of paper, one instruction per frame (Fig 11). The frames are of course numbered. A separate sheet is needed for temporary stores A and B (Fig 12), and maybe another for output of results. All is now ready.

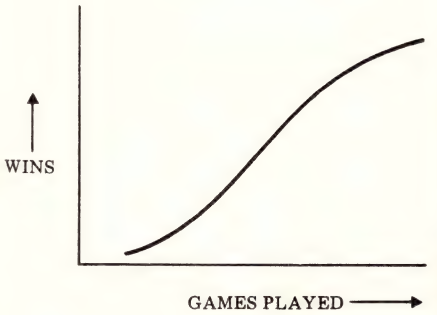


Fig 16

With the long strip of paper pulled down so that the instruction START is displayed, the user pulls the strip up to the next frame and obeys the instruction on it before moving on to the next. Temporary stores A and B are written IN PENCIL, any previous entries being erased. Instructions to jump are of course obeyed by pulling the strip through until the correctly-numbered frame has been found.

This is a salutary exercise and one that's thoroughly recommended. Students soon begin to appreciate how much the computer has to 'whizz backwards and forwards' in order to produce an answer to even the simplest of programs.

Another lesson learned is irretrievable loss of information. Once data has been erased from the temporary stores A and B, there's simply no way of getting it back; indeed the only way of obtaining it in the first place would be to alter the program so that it prints it out.

Students can now be instructed to alter the program so as to produce an answer to a different problem — for example 4 times 5 — and then run it to check that the answer obtained is the one expected. Once this has been mastered, try altering the structure of the program so that they have to program simple division or even to combine operations. It's also useful to have them count the total number of operations involved.

Matchbox computer

Another variation on the same idea is to obtain a number of empty matchboxes — say a dozen — and bind them together with sticky tape (Fig 13). The boxes are numbered and, as an added touch, may have a tag of tape attached for easy pulling. To program the machine, slips of paper carrying the instructions or data are inserted into the appropriate drawers.

The method is only really suitable for children — adults find the drawers very fiddly — but a suitable alternative for us old 'uns is a set of those plastic drawers that are sold for the storage of bits and pieces.

Noughts and crosses is a simple game that lends itself admirably to demonstration by matchbox computer and, as an added bonus, we can demonstrate the ability of the computer to learn by its mistakes — a concept that many people find disturbing.

Three sets of boxes are needed, with nine boxes to each set. They are bound together as before and the sets numbered 2 — 4 (Fig 14); set number 2 represents the computer's second move, number 3 its third move and number 4 its fourth move. We don't need a set for the computer's first move since, for the sake of simplicity, the computer always goes first and always puts its 'X' in the top left-hand corner — square number 1 (Fig 15). To complete the preparation, 8 little cards are placed in each drawer, numbered 2 — 9. They may be well shuffled.

Play begins. The computer is assumed to put an X in square 1 and the human player keeps track of the game. (S)he replies as seems reasonable — let us suppose an 0 in square 5. To determine the computer's response, the student takes the set of boxes representing the number of the computer's move (in this case 2) and opens the little drawer numbered the same as his own LAST move — in this case 5. Whatever little card is on top of the pile inside is the computer's move. Let us suppose that it's 4. The player replies, then goes to the set of boxes for the computer's third move (following the same rules as before) and opens the box corresponding to his own last move. In the circumstances given this was probably 7.

Play proceeds in this way until a result is obtained — almost certainly a victory for the human player.

Various conditions of play will arise. Firstly, the computer may attempt a move to a square already occupied, in which case the card with this move is placed at the bottom of the pile in the drawer and the next one taken. If a drawer opened has no cards in it, or if all squares indicated are occupied, the computer withdraws and concedes defeat.

Now for the learning process. When the human player wins a game, the card representing the computer's last move is taken out of the drawer and discarded; it won't make THAT error again. Finally, if discarding a card results in a drawer now becoming empty the previous move is discarded since all paths from it result in disaster. Options are reopened by replacing all the cards for the subsequent drawer. For example, suppose that drawer 2, move 4 becomes empty. We must ask ourselves what led up to this situation? Suppose that it was a move to square 8 in move 3. We remove this card and replace all of the cards in drawer 2, move 4.

You'll find that, over a number of games, the computer first loses all, then slowly begins to win; at the end it'll be very hard to beat — in fact, following the classic learning curve (Fig 16). Children with the stamina to play a lot of games will be interested to watch the process in operation. Other forms of teaching by games will be looked at later.

Perhaps the greatest single lesson to be learned from computer models is the absolute necessity to be accurate when programming. The computer is itself totally on the ball and logical but it relies ultimately on humans both to program it and to feed it with accurate information. There's an old saying in the computer industry that's well worth repeating, 'garbage in — garbage out'.

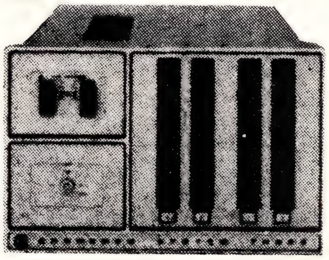
It's fast becoming a necessity for the public at large to have some knowledge of programming. I don't mean that all and sundry should be able to sit down and program a computer . . . more that they should know about the basic principles. I feel we must aim to build up a population that will not automatically genuflect when they hear that this or that data has been computerised.

Better than that, the public must begin to question computer results. This is done already to some extent, but the emphasis is in the wrong place, with the result that the computer stands in danger of derision. It's simply not good enough for commercial and industrial concerns to offer the limp excuse, "Sorry — our computer made a mistake." If a hapless pensioner receives a gas bill for $99999.99, then either it was programmed incorrectly or some human fed it with wrong information.

As computers find their way into more and more schools it'll become commonplace to hear adults who don't know any better castigate children as lazy — because they imagine that the computer will do all the child's work for him or her.

All such people overlook the simple fact that in order to use the machine, one must first control one's self. In order to drive a car, we must first learn to gain complete control over legs, arms, hand and eye. Similarly, in order to program a computer to fulfil a task, we must first know intimately how the job has to be approached. In order for our cardboard computer to multiply two numbers, we first had to know how to do it ourselves.

It's totally unacceptable that so many people — including the most articulate and intelligent — still approach me and say, "I'll tell you what you ought to get your computer to do . . .," then go on to describe something for which there is no known solution — like picking the Derby winner, eradicating poverty or banning wars. Their eyes glaze a little when one retorts, "OK, tell me how to do it and I'll shove it through the computer."



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APC-80

Version 2

By Ian Davies

This month in APC-80, we present a facility to speed up program entry that is so useful — people usually pay for it! We refer to "single key keyword entry".

You are probably familiar with the abbreviation for PRINT, i.e., "?". APC-80 extends the concept to provide shift L for LIST, shift S for STRING$, in fact, whatever you want. It's all done in about 80 bytes of machine code which includes a translation table to convert characters to commands. The meaning of each shifted key can be re-programmed by each individual for the format he finds most useful and most evocative.

The key assignments presented are just one of a large number of possible arrangements. The choice of the best key for a particular keyword is not easy as there are many keywords beginning with the same character (e.g., P, C, etc.). We decided not to assign keys for PRINT and REM since these already have abbreviations. Similarly, words like TO and IF were excluded as they only involve two keys anyway. The abbreviations have greater flexibility than the Tandy standards, for instance, LLIST can be entered by L followed by shift L, whereas the Level II interpreter doesn't allow LPRINT as L?.

The key entries result in the full keyword being placed in the I/O buffer and on the screen so shift L produces the word "LIST".

The key values can be re-assigned by changing the command code at the relevant point in the command table. This table is in alphabetical order so that the first table entry is for shift A and the contents are F6, (the code for ASC). The second entry is for shift B and its contents are 83 (the code for SET).

It's probably a good idea to change the assignments for yourself as it is for your own use and there is no reason to maintain any standards or conventions. We did find that the arrangement is not particularly important; you will become accustomed to whatever format you choose very quickly (certainly the first time you have to enter a reasonable sized program).

As this is the first of many upgrades to APC-80, we'll explain how to make the changes. Since you all used the same line numbers we did last month, all you have to do is CLOAD your APC-80 code (with all the data statements) and then type in the lines shown below. Some of the lines replace existing ones, some others are new. For the rebels who didn't use our line numbers, you will have to compare our upgrade list with the original APC-80 listing from last month and work out how it fits into your program.

How it works

The program is very simple in relation to its capabilities. It operates by testing each input from the keyboard driver for a shifted character. If it is shifted the corresponding command code from the table is loaded and stored in the location "DATA". The second byte of this location is zeroed to act as a delimiter for the ROM routine which is called to convert this code to string form and put it in the buffer "STRING". The ROM routine is actually part of the LIST logic. A zero delimiter is placed in the buffer after the last character of the command and a pointer set to the first character. Execution then drops through to FAKE which returns with the character currently being pointed to so as to fake that key being pressed and advance the pointer along the buffer one character.

Next time an input is encountered, the routine sees that the buffer has not been fully used (hence the test at the start of the program) and drops through to FAKE, returning with the next character from the buffer. Needless to say, it all happens very quickly.

There are several advantages to this system. Firstly, it can be used with disk systems as it is not concerned with manipulating the I/O buffer; this is taken care of by ROM routines. Secondly, it provides the flexibility discussed in the first part of the article. As far as the operating system is concerned, these characters were typed in at the keyboard — nothing magical about them. Therefore, the shifted characters can be used in print statements or comments, or even as INPUT to a Basic user program.

A — ASC
B — SET
C — CLS
D — DATA
E — EDIT
F — FOR
G — GOTO
H — GOSUB
I — INPUT
J — RESET
K — INKEY$
L — LIST
M — MID$
N — NEXT
O — POKE
P — PEEK
Q — CHR$
R — RUN
S — STRING$
T — THEN
U — USING
V — VAL
W — STR$
X — RIGHT$
Y — SYSTEM
Z — LEFT$

Basic listing

```
310 DATA C3, 85, 7D, 00, 03, 00, 03, 00
400 DATA 4E, 20, 32, 1A, 00
880 REM  KEYWORD ENTRY ROUTINE
890 DATA ORG, 32133
900 DATA 2A, B7, 7D, 7E, A7, 20, 22, CD
910 DATA E3, 03, FE, 61, D8, DD, 21, 62
920 DATA 7D, 32, 9B, 7D, DD, 7E, 00, 21
930 DATA B9, 7D, 77, 01, BB, 7D, CD, 8C
940 DATA 2B, AF, 02, 21, BB, 7D, 22, B7
950 DATA 7D, 2A, B7, 7D, 7E, 23, 22, B7
960 DATA 7D, C9, BB, 7D, 00, 00, 00, 20
970 DATA 20, 20, 20, 20, 20, 20
980 REM COMMAND TABLE, ALPHABETIC ORDER
990 DATA F6, 83, 84, 88, 9D, 81, 8D, 91
1000 DATA 89, 82, C9, B4, FA, 87, B1, E5
1010 DATA F7, 8E, C4, CA, BF, F5, F4, F9
1020 DATA AE, F8
1030 DATA END
```

Assembly code

```
03000
03010          ORG     32122
03020
03030 INITS    LD      HL,MAIN
03040          LD      (16406),HL
03050          LD      SP,0600H
03060          JP      06CCH
03070
03080 MAIN     LD      HL,(PTR)
03090          LD      A,(HL)
03100          AND     A
03110          JR      NZ,FAKE    ;
                IF BUFFER NON-EMPTY
03120          CALL    935D       ;
```

Continued on page 54

HELPING THE HANDICAPPED

It's often said that microprocessors will play a major role in aiding the handicapped but few companies seem interested in actually doing much about it. One exception is Telesensory Systems Inc, which specialises in aids for the disabled. Julia Charles reports from California on TSI's activities.

Telesensory Systems Inc (TSI) is a small advanced electronics company based in Palo Alto, California. The company is located on a hillside surrounded by idyllic views of the San Fransisco Bay and hills in an area where electronic companies are both numerous and flourishing.

TSI differs from the other companies, however, because of the specialised nature of its expertise for it concentrates on the application of sophisticated equipment for the handicapped, a field now entitled 'rehabilitation technology' in which a device may augment, substitute or enhance the physical or sensory limitations of an individual.

The company was formed in 1970 to produce and market the OPTACON (OPtical to TActile CONverter), a reading device for blind people which resulted from a research project led by Professor J G Linvill at the Department of Electrical Engineering, Stanford University.

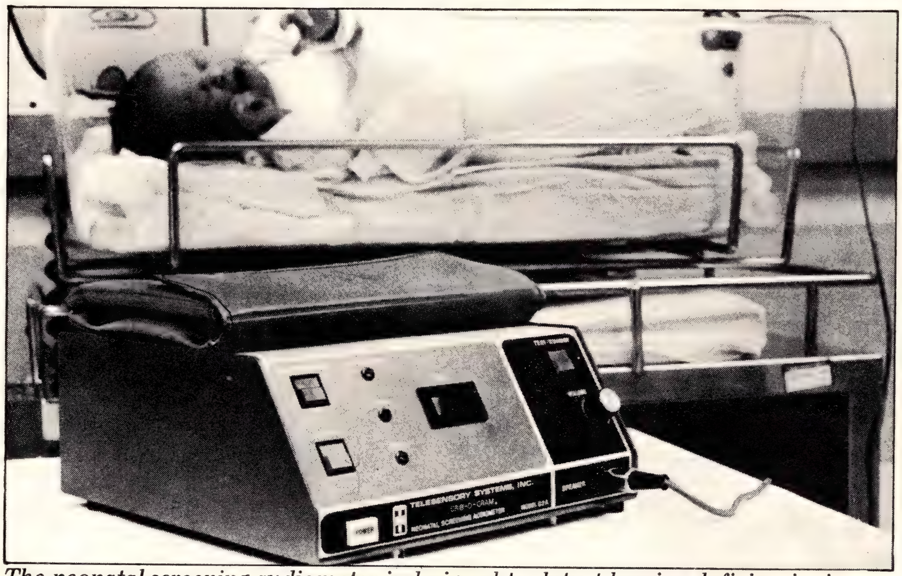
Professor Linvill developed the OPTACON after he realised the size of the barrier that the blindness of his daughter, Candy, imposed upon her ability to read. During that period Candy was at school and the time required for translating materials from print to braille, as well as the sheer bulk of braille material, were severe impediments to her studies.

The OPTACON is an optical to tactile converter that generates with an array of vibrating pins a tactile image which is a magnified facsimile of letters focused on its silicon retina. The OPTACON equipment comprises a hand-held camera and a box of electronics; as the user moves the camera across a line of print the optical impression from the camera is converted into electronic signals so that an enlarged, vibrating representation of the image the camera is receiving is displayed on a tactile array that the user feels beneath his index finger. The blind person is therefore able to read tactually in the same way that a sighted person reads visually — he feels the same shapes that the sighted see. The tactile array is a small rectangular pad about half an inch by one and a half inches, with 144 pins arranged in six columns.

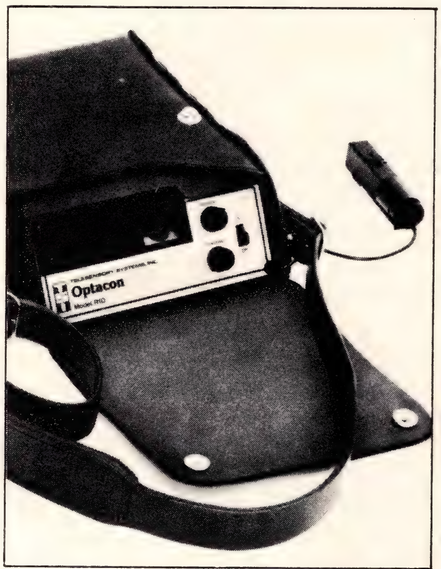
The research project at Stanford began in 1963 and by 1970 such an improved and compact model of the OPTACON had been developed that it was decided to put it into quantity production. However, commercially, its potential was extremely dubious; it's an expensive and esoteric device whose usefulness is restricted to a small, select population. The gulf between the university-based research product and the manufacturing and marketing capabilities required to bring that product to its intended market was so great that it was necessary to form a new company in an attempt to bridge the chasm. TSI was established for the purpose in 1970 with Dr J Bliss as President, and production of the OPTACON began in 1971.

The OPTACON Research Group at Stanford still continued with its aims of developing useful devices for blind people but as with any research organisation their findings were immediately available to TSI, as they were to any other interested party. The openness of this relationship was valuable, for it provided a safeguard to the blind population in ensuring that the only insurance TSI had against competition was its own effectiveness. TSI still maintains a close relationship with Stanford University and two Stanford faculty members are on its Board of Directors.

As a sophisticated device of use to a limited market, the OPTACON displays many of the features that necessarily characterise rehabilitation technology devices and which help to explain why this is an area where successful manufacture and marketing is so difficult to achieve: the research and development



The neonatal screening audiometer is designed to detect hearing deficiencies in newly-born babies.



The TSI Optacon, with its miniature camera to the right. The tactile 'reading' pad is visible inside the slot.

cost of equipment of this nature is high; a handicapped population is generally small and the usefulness of any particular device is limited according to the type and degree of disability of the user (not all blind people can use an OPTACON, for example); handicapped people are generally hard to locate and they often do not have a lot of money.

Bearing in mind these factors it's interesting to look at TSI's development over the past decade, to consider some of the reasons for its success and to review some of its products.

Firstly TSI has always received considerable financial support from government and non-profit based organisations, which has subsidised research and development costs. For instance, much of the work on the OPTACON was done at Stanford with government support, keeping the price of the OPTACON lower as it was not necessary to recoup these research and development costs. The government investment, however, has been adequately retrieved in that a blind person, with the increased capabilities that the OPTACON gives him, is able to be more productive in the economic society in which he is expected to participate.

Secondly, TSI has been able to transfer the technology developed for the OPTACON to a number of other products so that today it has several commercial products on the market which derive from two basic technologies: synthetic speech and bimorph transducers. To illustrate these transfers it is best to look at TSI's current range of products.

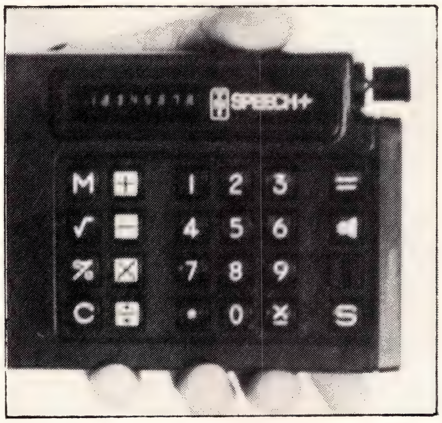
The second product TSI brought out utilised the first of these technologies, synthetic speech. The Speech + talking calculator was introduced in 1975 and was the first consumer product to provide voice output through microprocessor-generated speech. The calculator has a 24-word mathematical vocabulary and is available in English, French, German and Arabic speaking models.

The synthetic voice of the 'Speech +' is also the voice of TSI's Game Centre, a microprocessor-controlled collection of eight electronic games, similar to video games but using only synthetic speech output and other audible cues to provide game information to the players so it can be utilised by blind persons.

The same synthetic speech technology is also available as pre-assembled speech boards and so can be used for experimental purposes as well as in such products as the talking Chess Challenger.

Having moved into speech technology, the next development was obviously to make a talking OPTACON, as this would increase its utility both in education and vocational settings. Voice output and automatic scanner units are expected to be commercially available in 1982. The units have been under development for four years, stemming from work on speech synthesis originally based at the Massachusetts Institute of Technology. This autumn prototype units are to be evaluated in the field over the next year before final decisions are made concerning design features.

The second area in which TSI has employed technology transfer has been in the area of bimorph transducers. These were originally utilised in the OPTACON and are now incorporated in both the Crib-O-Gram and the VersaBraille.

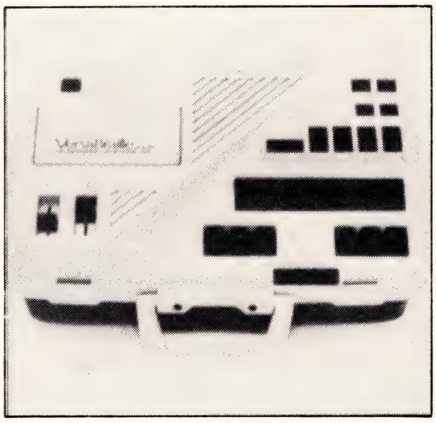

TSI's Speech+ talking calculator for the blind.

The Crib-O-Gram is a neonatal screening audiometer and was initially conceived and developed by Dr F Blair Simmons at Stanford University Medical Centre. The technology was transferred to TSI under licence from Stanford University. The Crib-O-Gram identifies serious hearing impairments in newborns, using a narrow band noise stimulus, a highly sensitive motion detector and a microprocessor-based decision analysis to assess neonatal motor activity in response to a series of 30 stimulus trials. Early identification of hearing impairment allows early treatment to facilitate the normal development of language and cognitive faculties that may otherwise be seriously impeded if the hearing deficit is not diagnosed until the child is two or three, which is an average age of detection by conventional means.

The VersaBraille is a portable microprocessor-based Braille information processing system which allows quiet and efficient writing, reading and note-taking as well as being a compact and economical way of storing Braille text. It's also an audio tape recorder which can record sound and Braille on the same tape and can provide an index and automatic retrieval system for both audio and Braille materials. Attachments for computers, typewriters and teletypewriters increase the system's usefulness in many vocational settings.

TSI has therefore utilised the spin-off of two particular technologies to produce seven successful products. The success of these products may be attributed to the clearly defined organisational objectives that provide TSI's goal when new products are being developed: that the product must fulfill a real customer need, that it provides lasting value and represents an unmatched contribution in the marketplace, and that it matches the marketing and manufacturing strengths possessed by TSI. Also, it should be a profitable concern.

An example of the application of these principles to a new product may be seen in the Autocom project, now nearing completion. The Autocom is a device which was originally developed at the TRACE Centre for the Severely Communicatively Handicapped at the University of Wisconsin. The rights to develop, manufacture and market the Autocom were awarded to TSI in 1978 and it is hoped that it will be in production later this year. The Autocom is a communication system for individuals who are both motorically and vocally impaired. It allows a user to select, store and display vocabulary items by moving a pointer to a chosen square on the board's grid surface. The board is housed in a wheelchair laptray, giving the user complete freedom of mobility. The vocabulary store is user-programmable and can be simple or complex in that vocabulary items can be symbols, pictures, letters, numbers, words or word parts, phrases or sentences. By using many 'levels' of electronic memory several thousand different items may be stored and the user programmability means that each individual may create and modify his own personal vocabulary. The variety of input and output modes available also helps to make the Autocom suitable for a wide range of users.


The VersaBraille is, in effect, almost a word processing system for the blind.

TSI came into being 10 years ago to research, develop and commercialise rehabilitation devices. It was entering a new and complex field in which the probability of success was low. However, during the 70s it not only established itself as a world leader in its specialised fields but is now in a position where it is able to broaden the range of these fields. The potential applications for products utilising high quality voice synthesisers are both numerous and obvious and will benefit areas both of disability and non-disability. The reputation TSI has gained for quality and reliability should ensure the continuing support of government and non-profit making organisations so allowing it to retain its heavy research bias, and although the company is expanding it is still sufficiently small to be involved in custom design development.

TSI came into existence because it wanted to introduce a new product in a new market, a risky venture for any commercial organisational framework is specifically designed for its particular needs and is fluid to allow for adaptations to changing environments. Its standards of research, development, production and maintenance and assessment and training of users are extremely high, as is the level of expertise demanded from its staff. TSI has been successful because it has been able to offset risk-taking against these high standards.

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ZX80 CORNER

The material for this ZX80 page in Australian Personal Computer comes from the National ZX80 Users Club.
Details about the Club can be found at the end of this article.
The National Users' Club welcomes comments and suggestions for this ZX80 page.

ZX80 display file

Many people attempting to copy programs written for other machines on to the ZX80 may be perplexed by the way they don't convert easily. This is especially so in the case of programs where a POKE is attempted on to the screen.

The ZX80 is different in that it does not have a special area of memory devoted for the screen display. The screen display uses part of the normal memory, and as you may have gathered from the manual, is not of constant size.

In fact, at the beginning of a program the amount of memory dedicated to the screen display is only 25 bytes: all of them filled with end-of-line markers. (In other words, all 24 lines contain nothing — the screen is blank). Then as the program encounters PRINT statements, the screen display increases, to a maximum of 32 characters on each of 24 lines.

As if this problem of indefinite size were not enough, the location of the screen display in memory keeps changing during the execution of the program. New variables called, or changes to strings, move the display file back and forth. Fortunately, we can find its location at any one time by PEEKing at the memory locations which contain the starting address of the display file:

```
eg LET V=PEEK (16396) + 256*
PEEK (16397)
```

There is one way however to fix the size of the display file and to stop it moving around in memory. The size can be fixed by filling up the display file with blanks to the maximum number (or any desired number if print statements are not to be used). One simple way to do this is:

```
100   FOR A = 1 TO 23
110   PRINT , , , ,
120   NEXT A
```

. . . . rest of program. Please note the difference between PRINT ,,,, and PRINT — the former fills a line with blanks, while the latter moves the pointer to the next line without filling the line at all.

In order to stop the display file from moving, it is necessary to define all the variables which are going to be used in the program, including all variables to be used in loops.

```
eg  10     LET X = 0
    20     LET Y = 0
    30     LET Z = 0
    40     FOR A = 0 TO 1
    50     NEXT A
```

After all this, it is now possible to POKE into the display screen, just as if the ZX80 had a memory-mapped display.

One point to watch out for are the end-of-line characters: they need to stay in there to tell the ZX80 what is going on, and you can get some amusing effects if you POKE something else where an end-of-line character used to be.

If only a couple of end-of-lines were deleted, you can fix things by POKEing them back in. (The end-of-line character is 118.)

Flicker free displays

Q. Dear Sir,
I am writing to find out whether it is possible or not to make something move across the screen without flickering or jerking using the ZX80. If it is possible, could you tell me some method for doing this?

A.D.Frew

A. The reason the ZX80 flickers every time a key is pressed is closely related to its design and construction.

Instead of having a separate circuit and chips for computing and another one for the display, the CPU of the ZX80 does both! So, it can either work on the program or it can display the screen — it can't do both things at once. (This also explains why the screen goes black when it is involved in a long calculation.)

Unfortunately, this means that no simple remedy is available, such as POKEing a machine language routine.

On the good news side, we are advised that some people are working on programs which by use of machine language programs with very strict timing control effectively give the ZX80 a moving-graphics flicker-free display!

We will keep you informed of these developments through this page as things happen.

Letter arithmetic

The following program is one which creates multiplication puzzles with the numbers replaced by letters of the alphabet. The puzzle is to work out which letter is which number.

```
eg        ABC
        x AEF
       ------
        AIAHH
     +  ZGHID
       ------
        BGZHB
```

(in the above example,
A=1, B=2, etc., I=9, Z=0).
To enter a guess, enter the letter followed by the numbers guessed — eg "M7".
To stop, enter "QUIT".

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```
100  DIM  A(9)
110  RANDOMISE
200  FOR I = 0 TO 9
210  LET X = RND (26) + 37
220  FOR J = 0 TO 9
230  IF A(J) = X  THEN GO TO 210
240  NEXT J
250  LET A(I) = X
260  NEXT I
300  LET X = RND (170)
310  LET Y = RND (170)
320  LET Z = RND (3000)
330  CLS
400  LET N = X
410  PRINT ,
420  GO SUB 1000
430  LET N = Y
440  PRINT "X",
450  GO SUB 1000
460  LET N = X * Y
```

Continued on page 54

ADE

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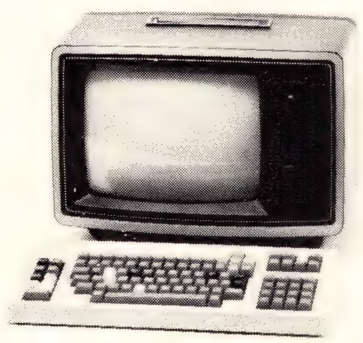

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FACE TO FACE

This month David Hebditch considers ways of hotting up input procedures.

Last month's discussion of 'free-format' dialogues covered a style which seems to be most appropriate to applications where the display terminal has limited functionality and/or power. However, it is possible to achieve a much higher level of 'user friendliness' in situations where more control can be exercised over the use of the keyboard and display.

'Formatted' dialogues are structured to limit the degree of freedom available to the user and, thereby, reduce the possibility of things going wrong. In this article we shall consider three main types of structured dialogue:
— menu selection
— instruction-and-response and
— 'forms mode'.

Menu-based dialogues can make a major contribution to ease-of-use. The fundamental concept is that at each key stage in the dialogue, the user is presented with a range of possible options on the screen. Each of these is numbered so that the choice may be made merely by typing the number of the choice required, just like ordering food in a Chinese restaurant! Menus may be implemented at a control level or as a means of selecting data. For example, at the beginning of a sales accounting program, the user might see the following:

```
SALES ACCOUNTING
FACILITIES AVAILABLE ARE:
0. FINISHED WITH SALES
   ACCOUNTING.
1. EXAMINE/MODIFY
   CUSTOMER RECORD.
2. ADD NEW CUSTOMER
   RECORD.
3. ENTER ORDER.
4. POST CASH RECEIVED.
TYPE NUMBER OF FACILITY
REQUIRED:__
```

This type of menu has almost become a classic. Assuming that the supporting program is written in Basic, the programmer can employ the useful ON. . .GOSUB command as below:

```
        .
        .
        .
1000   GOSUB  12000: REM DISPLAY MAIN MENU
1010   GET K$          : REM READ KEY PRESSED
1020   IF ASC (K$)< 0 OR ASC (K$)> 4 THEN GO TO 1010:    REM CHECK 0—4
1030   K = VAL(K$): REM CONVERT TO NUMERIC
1040   IF K = 0 THEN GOTO 19999: REM END
1050   ON K GOSUB 2000,3000,4000,5000: REM CALL PROCESSING SUBROUTINES
1060   GOTO 1000: REM BACK TO MENU.
        .
        .
        .
2000   REM SUBROUTINE TO EXAMINE OR MODIFY A CUSTOMER RECORD
        .
        .
        .
```

If the user types '1' then this will cause the program to call the subroutine at statement 2000 which may then display a further menu for the particular functions it provides; examine customer record, delete customer record, modify customer record and so on.

There are at least two advantages to this approach:
— it is clear to the user at each stage in the dialogue exactly what can be done next (thus minimising the need to refer to manuals) and
— it is easy for the programmer to extend the program merely by adding a further option to the menu list, extending the range-check at statement 1020, adding a further subroutine address to the ON. . .GOSUB statement at 1050 and by writing the new subroutine itself.

The user does not need to learn command words and can select the option merely by typing a single key.

The technique can also be applied at 'data' level. For example, if the user wishes to enter some product descriptive information, the system could help by describing the options:

```
A4  2-RING BINDER WITH 2 INCH
SPINE.
THE COLOUR OPTIONS ARE:
1. BLACK          5. BRIGHT RED
2. BROWN          6. MAGENTA
3. WHITE          7. PURPLE
4. GREEN          8. BLUE
SELECT COLOUR REQUIRED: __
```

Here the user merely needs to press a single key in order to enter the colour code. To work effectively, only the colours actually available for the product concerned (A4 2—RING BINDER, etc) should be displayed. This makes it (theoretically) impossible to get an error message. Where the range of options is small, it might be effective to display more than one selection (colour, size, number of rings, etc) on the same screen.

A word of warning: the response time of 'data entry' applications of menus must be very fast if the user is not going to become frustrated with the speed of the system overall. After all, what the user does is fast so why can't the computer keep up?

Instruction-and-response (or 'question-and-answer') dialogues apply predominantly to data input. The technique has been around for a long time but really gained prominence through the use of Basic on multi-access minis and on single-station micros. The classic exchange is:

```
100 PRINT "ENTER NAME";
110 INPUT NM$
```

or, in its more streamlined version,

```
100 INPUT "ENTER NAME"; NM$
```

Consequently the dialogue is built up as a whole series of questions and answers, some of which may be multi-part, as shown below:

```
100 INPUT "PRODUCT CODE"; PC$
.     (Checking routines)
.
.
200 INPUT "PRODUCT DESC"; PN$
.
.
.
300 INPUT "QUANTITY UNIT";QU$
.
.
.
400 INPUT "PURCHASE PRICE"; PP
.
.
.
```

and so on. This may appear on the display as:

```
PRODUCT CODE? GA439
PRODUCT DESC? PENCILS(HB)
QUANTITY UNIT? DOZ
PURCHASE PRICE? 1.45
```

This is a simple and straightforward dialogue from the user point of view and can be applied to a wide variety of systems. However, the technique does not make full use of the formatting capabilities of the screen. Further, the use of simple INPUT statements in Basic can produce problems all of their own. For example, if you press RETURN on the PET without entering any data the system exits the program. Embarrassing.

On many commercial display terminals today, it is possible to make use of a facility for 'formatting' a screen so that its use resembles the filling-in of a form. This is achieved by being able to specify (through the use of control characters) that some areas of the screen, once set up by the program, are 'protected', ie cannot be modified from the keyboard. Other areas are 'unprotected' and can be used for data entry from the keyboard. The actual control characters used to implement this technique vary enormously from display to display, there being no provision in ASCII for this capability.

In the following example, I am using '[' (left square bracket) to indicate *start input field* and ']'(right square bracket) to indicate *end input field.* The screen is initially displayed with the input fields blank and the cursor positioned at the beginning of the first item.

```
DATE: [         ]
A/C NUMBER: [          ]
AMOUNT: [          ]
TRANS. TYPE: [  ]
```

The underline indicates the position of the cursor. Seven characters are allowed for the date which is entered in the DDMMMYY format. When the last character is typed the cursor will automatically skip to the beginning of the next field (A/C NUMBER). This continues until the last item has been entered:

```
DATE: [24APR80]
A/C NUMBER: [4978465]
AMOUNT: [124.50]
TRANS. TYPE: [C]
```

In the case of items which do not fill the available space, the user will have to press a special key (usually TAB) to indicate that he has finished and to force the cursor to the next item. When the transaction has been completed, a single command can be used from the program to clear the input items *only* and to return the cursor to the start. In the above example, even better use can be made of the screen by changing the format as follows:

```
              TRANSACTION INPUT
DATE   ACCOUNT   AMOUNT   TRANS
       NUMBER             TYPE
[    ] [       ] [       ] [    ]
[    ] [       ] [       ] [    ]
[    ] [       ] [       ] [    ]
[    ] [       ] [       ] [    ]
[    ] [       ] [       ] [    ]
  .        .        .        .
  .        .        .        .
  .        .        .        .
```

. . . and so on for as many lines as you can fit on the screen. This technique is also possible on memory-mapped video systems such as the Apple and PET. In these cases the effect is achieved not by the use of control characters but through the judicious use of cursor control and the Basic GET command. More ideas on the 'forms mode' style of dialogue will be discussed next month.

Continued from page 47

```
                              ELSE CALL INPUT
 03130          CP       97           ;
                              TEST FOR SHIFT
 03140          RET      C            ;
                               RETURN IF NOT
 03150          LD       IX,TABLE-97
 03160          LD       (LOAD+2),A
 03170 LOAD     LD       A,(IX+00)    ;
                    CONVERT TO COMMAND CODE
 03180          LD       HL,DATA
 03190          LD       (HL),A       ;
                           HL POINTS TO CODE
 03200          LD       BC,STRING    ;
                         BC POINTS TO BUFFER
 03210          CALL     288CH        ;
                           CONVERT TO STRING
 03220          XOR      A
 03230          LD       (BC),A       ;
                    ADD DELIMITER TO BUFFER
 03240          LD       HL,STRING    ;
                        RESET BUFFER POINTER
 03250          LD       (PTR),HL
 03260
 03270 FAKE     LD       HL,(PTR)     ;
                             RECOVER POINTER
 03280          LD       A,(HL)       ;
                         PICK UP CURRENT CHAR
 03290          INC      HL           ;
                             ADVANCE POINTER
```

```
03300          LD       (PTR),HL    ;
                        SAVE POINTER
03310          RET
03320
03330
03340 PTR      DEFW     STRING
03350 DATA     DEFW     0000H
03360 STRING   DEFB     0
03370          DEFM     '          '
03380
03390
03400 ;  COMMANDS          CHARS

03410 ;            ---------    ----
-
03420 TABLE     DEFW      83F6H   ; B,A
03430           DEFW      8884H   ; D,C
03440           DEFW      8190H   ; F,E
03450           DEFW      9180H   ; H,G
03460           DEFW      8289H   ; J,I
03470           DEFW      0B4C9H  ; L,K
03480           DEFW      87FAH   ; N,M
03490           DEFW      0E5B1H  ; P,O
03500           DEFW      8EF7H   ; R,Q
03510           DEFW      0CAC4H  ; T,S
03520           DEFW      0F5BFH  ; V,U
03530           DEFW      0F9F4H  ; X,W
03540           DEFW      0F8AEH  ; Z,Y
03550           END
```

Continued from page 51

```
470 PRINT , "- - - - -" ,,,,
480 GO SUB 1000
490 LET N = Z
500 PRINT "+",
510 GO SUB 1000
520 LET N = Z + X * Y
530 PRINT, " - - - - -" ,,,,
540 GO SUB 1000
600 PRINT "ENTER LETTER AND NUMBER
   GUESS: Δ ΔCORRECT WILL BE PRINTED'
610 INPUT N$
620 IF N$ = "QUIT" THEN GO TO 700
630 LET X = CODE (N$)
640 LET I = CODE (TL$(N$)) - 28
650 IF  I < 0 OR I > 9 THEN GO TO 610
660 IF NOT  A(I) = X THEN GO TO 610
670 PRINT N$; "Δ";
```

```
 680 GO TO 610
 700 PRINT " THE CODES ARE  Δ " ;
 710 FOR I = 0 TO 9
 720 PRINT CHR$(A(I)); "="; I; "Δ";
 730 NEXT I
 740 STOP
1000 LET I = 4
1010 IF N < 1000 THEN PRINT "Δ Δ" ;
1020 IF N < 1000 THEN LET  I = 2
1030 LET J = N / 10 * * I
1040 PRINT CHR$(A(J));
1050 LET N = N - J * 10 ** I
1060 LET I = I - 1
1070 IF NOT I < 0 THEN GO TO 1030
1080 PRINT
1090 RETURN
```

(Note: The symbol **Δ** is used to denote a single space.)

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Atom ($780*)	Sinclair Equipment Australasia Pty Ltd (03) 861 6224	4-12k RAM; 6502; Full K/B; C int; TV int; 20 I/O lines; 1 P/P	Basic in 8k ROM; A; Cass O/S	High resolution graphics on bigger model; colour monitor O/P. Loudspeaker. Note also, systems based on Acorn SBC (B).
Archives	Computerland (03) 62 5581	64k RAM; Z80; dual 5¼. F/D (744k) 12", 24x80 VDU; S/P; P/P; N/P. Option 1.5 Mb F/D	CP/M	(E)
Century (C100 – $4950: C200 – $5400)	Abacus Computer Store (03) 429 5844	C100, 48-64K RAM: Z80: 12" VDU: 2x5¼" F/D (2x143K): 112 cps printer: RS 232 port; S100 bus: C200 includes 2xF/D (2x315K); hard disk 4xRS232: 2x P/P	*Cobol; Fortran; Basic*	Also available: C300 (I)
Challenger IP ($448)	Systems Automation (02) 439 6477	4-32K RAM; 6502; C int; 24x32 VDU int; RS232 port: option – dual 5¼" F/D (140K)	O/S Basic; A; games	8K microsoft Basic in ROM; expansion board available (I)
Challenger 4 ($871)	Systems Automation (02) 439 6477	8-48K RAM; 6502; colour 32x64 VDU int; RS232 port; P/P; option – 6502C microprocessor; dual 5¼" F/D (140K)	Basic:*Pascal*	Basic in 8K ROM (I)
Compucolor II ($2095)	Anderson Digital Equipment (03) 543 2077	8-32K RAM; 8086: 13" 32x64 8 colour VDU; single 5¼" F/D (51K): RS232 port	ExBasic (ROM); *A*	16K model, $2395; 32K $2695; maintenance manual available (I)
Cromemco System 2, System Z2H, System 3 ($3990, $9650, $6750)	–	64-512K RAM; Z80A; System 2, dual 5¼" F/D (346K); System Z2H, also Winchester disk (11MB); System 3, 8" dual 1MB; S/P; P/P	CDOS; *Basic Cobol; Fortran; M/A; ExBasic; Structured Basic*	All Systems expandable to multi user (2-7 users) $2880 – $8825 (E)
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Exidy Sorcerer Model II ($1295*)	Dick Smith Electronics (02) 888 3200	8-48K RAM; Z80; 30x64 VDU int; RS232 Port; P/P; S100 bus; extra C int.	O/S; Ex Basic (ROM) *; M/DOS; CP/M*	High res graphics capability; 16K version $1395*; 32K version $1525*; 48K version $1655*; User programmable character set (I)
HP-85 ($3550)	Hewlett Packard Australia (03) 89 6351	16-32K RAM; N/A; 5", 16x32 B/W VDU; C(200K); 64 cps printer: RS232 port; 4xP/P	Basic	Full dot matrix graphics: N/P; compact portable unit (S)
IPS-100 ($3750)	Microprocessor Applications (03) 754 5108	32-896K RAM; 8085; 2 RS 232 ports; S100 bus; dual 5¼" F/D (630K)	O/S; Ex Basic; Ed; A; *CP/M; C Basic; Fortran Cobol*	(E)
Industrial Micro Systems ($2747)	S.I. Micro-computer Products P/L (02) 231 4091	32-64K RAM Z80A 5¼" F/D (170K) 2xSP Optional to 100M VDU $1250, P/P 8" F/D ditto but to 2400K	O/S CP/M Basic Cobol; Fortran; Pascal	Multi terminal capability Interrupt driven 80 char x 24 lines Ditto x Hard Disk 24M up option ($4565) (E)
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National Panasonic JD740 ($8550)	The Computer Company (02) 436 1733	64K RAM; 2–4K PROM; 8085A; 3 RS232 ports; 2x5¼" F/D (560K) 1920 ch. green phosphor VDU	Panabasic, Interpreter Microsoft Basic, Fortran, Cobol & Assembler	Price depends on systems configuration (E)
North Star Horizon ($2695)	S.I. Micro-computer Products (02) 231 4091	32–64K RAM; Z80A; 5¼" F/D (170K); 2xSP; 1 P/P; optional – VDU ($1350); Quad density F/D	DOS; Basic; *Cobol: Fortran Pascal; CP/M: M/A*	(E)
PET 8k, 16k & 32k ($1199*, $1859*, $2249*)	Commodore Information Center (02) 437 6296	8–32K RAM; 6502; C; 9" 25x40 VDU; IEEE–488 port; Options: dual 5¼" F/D (353k) $2305; same but (950k) $3100	O/S; Basic (in 8k ROM); *Forth, Pilot, Pascal*	Disk controller $109 (I)
Sinclair ZX80	Sinclair Equipment Australasia Pty Ltd (03) 861 6224	1–16 K RAM; 780 –1; C int; T.V. int; full K/B 44 pin expansion port	4K Basic in ROM	CPU is Nec 3.25 MHz version of Z80A (I)
Sord M100 ACE III ($4500)	Alliance Digital Corporation (02) 436 1600 Abacus Computer Store (03) 429 5844	48K RAM: Z80: 24x64, 12"VDU; RS232 ports; 2x5¼" F/D (2x143K); S 100 bus; 2 octave speaker; A/D Conv.; option: 8 colour graphic controller ($1450)	O/S: Ex *Basic Fortran*	M100 ACE IV – 8 colour graphics controller incL.
Sord M223 ($7500)	Alliance Digital Corporation (02) 436 1600 Abacus Computer Store (03) 439 5844	64K RAM; Z80: 12" 24x80 VDU; 2xRS232 port: S100 bus: 5¼" FD (350K)	O/S; *Ex Basic; Fortan; Cobol*	(I)
Superbrain ($3500)	–	64k RAM; 2xZ80; dual 5¼" F/D (320K) 12", 25x80 VDU; S100 bus; RS232 port	CP/M; A; *Basic, Cobol, Fortran, APL; Pascal*	Limited graphics. Main frame int. available. Options: dual 5¼" F/D (320K); dual 8" F/D 2.4 Mb); 8–120 Mb H/D (S & H)
System 80 ($615*)	Dick Smith Electronics (02) 888 3200	16K RAM; Z80; 500 bps C; 32x64 TV int; 1 P/P	Basic:*M/A; Fortran*	(I)
Tandy TRS-80 Model 2 ($5300*)	Tandy Electronics (02) 638 6633	32–64K RAM; Z80A; single 8" F/D (500K) 12", 24x80 VDU; 2 S/P; 1 P/P; N/P	DOS:Basic	64k version $5999* expandable to four F/D drives, single drive expansion $1999*: three drive $3999
TI 99/4 ($1499*)	Canberra Television	16K RAM; 26 K ROM; 9900; 24x32 VDU; 2x C int; TV int; RS232 port	O/S; Basic	Can run 16–colour TV screen (S)
TRS-80 Level I ($699*)	Tandy Electronics (02) 638 6633	4–16K RAM: Z80; C; 12", 16x64 B/W VDU	Basic; Games: A	Basic in 4 K ROM; upgradable to Level 2 (I)
TRS-80 Level 2 ($879*)	As above	4–48K RAM; Z80: C;12" 16x64 B/W VDU; RS232 port; P/P	Basic:*M/A; Fortran; Cobol*	16k machine incl. N/P; 4–16K upgrade $320*; ($250* without N/P); max config. $1169*; option – single 5¼" F/D (78K); max of 4
Vector Graphics System B ($6350)	A J & J W Dicker (02) 524 5639	64K RAM; Z80: Dual 5¼" F/D (630K); 12" 24x80 B/W VDU; S/P; 2x P/P	DOS: Basic:A; CP/M; Ed	Graphics and numeric pad (E)
Versatile 4 ($5692)	Micro-processor Applications (03) 754 5108	32–56K RAM; 8085; 9", 24x80 B/W VDU; dual 5¼" F/D (630K); S100 bus; 2xRS232	MBasic: MDOS including T/E and A; *Version 4 MDOS AND Basic: CP/M*	(E)

SINGLE BOARDS

Aim 65 ($525*)	Dwell Pty Ltd (02) 487 3111	1–4K RAM; 6502; 8K ROM; full K/B; 20 character LED display: 20 character thermal printer; Cx2 int: 1 P/P	8K monitor in ROM; *A: Basic*	Case available $75* (E)
SBC 100 ($299)	Microtrix (03) 718 2581	1K RAM: Z80: 8K ROM; S100 bus; 1 S/P; 1 P/P	1K monitor; DOS in ROM	Also available assembled $374 (E)
Superboard ($360)	Systems Automation (02) 439 6477	4–32K RAM: 6502: 10K ROM; full K/B; 24x32 VDU Int; C int; options – RS232; dual 5¼" F/D (140K)	Basic:games	Basic in 8K ROM (I)
UK 101 ($595*)	Compshop Australia	4–8k RAM; 6502; full K/B; 16x48 VDU or TV int; C int; RS 232 port. Options: 4 k RAM, $85	1k monitor; 8k Basic; *A*	Graphics. Will run Superboard software (S & H)

List of Abbreviations

A	Assembler
B	Basic
C	Cassette
E	Extensive
F/D	**Floppy disk**
G/C	**Graphics card**
H	**Hardware**
H/D	**Hard disk**
I	**Introductory**
Int	**Interface**
M/A	**Macro assembler**
N/A	**Not available**
N/P	**Numeric pad**
O/S	**Operating system**
P/P	**Parallel port**
S	**Software**
S/P	**Serial port**
T/E	**Text editor**
TBA	**To be announced**
U	**Utility**

Please note: Software items listed in *italic* are not included in the basic price of the equipment.

APPLE·CATIONS

by Ian Webster, Co-editor of the NSW Apple Users Group Magazines 'Applications' and co-ordinator of the Computerworks Project.

This column is for the Australian Apple User community and those interested in the world of the personal computer. Yes! Contributions are welcome.

The NSW and WA Apple Users Groups were very active in 1980. The NSW AUG meets in the Science Centre, 35 Clarence St., Sydney, on the second Monday of every month at 6.30 p.m. It has a Program Library, Special Interest Groups and publishes a monthly newsletter and the quarterly magazine Applications.

Membership enquiries to:—
John Smith (02) 389 4394
4/15 Raine St., Woollahra, 2025.

The West Australian AUG has an interesting monthly newsletter and a Program Library which includes several UCSD Pascal disks from the US based UCSD Pascal Users Group.

Membership enquiries to:—
Clevon Royall (09) 384 3576
269 Marmion St., Cottesloe, 6011.

The International Apple Core is a User Groups' User Group. The IAC was established at the 5th West Coast Computer Faire to provide information and software transfers between Groups. There are over 160 member Groups at present who receive IAC software disks, Ap-Notes (the original Apple Application notes) and the Apple Orchard magazine. Membership is $50 from the Australian IAC director:—
Roger Keatings (02) 389 2994
Box 4482, Double Bay, 2028.

Despite the tremendous interest in Apple Inc.'s release of 5 million shares into the New York stock exchange (US$17 a share), there has been a lot of grumbling from west coast USA user groups about the effects of Apple Inc.'s expansionist policies.

New Year releases will include The Apple III (but without Pascal until April), and an upgrade of UCSD Pascal to 1.1. Also to be seen is a Revision-8 Apple II motherboard, without the RAM strapping blocks, and with new electronics to support the Apple II J-Plus (J stands for Japanese Apple, complete with Katakana Character Generator).

Apple released a fury of software in October with DOS 3.3 (16 sector version of DOS 3.2), (almost) ANSII-77 Fortran, PILOT, the long awaited Apple Inc. version of the TED II+ Assembler/Editor and several game packages.

The Apple Assembler is disk based and can assemble relocatable object modules. A new file type 'R', for Relocatable binary file, has been added to the existing A,I,B,T types. The assembler is a little cumbersome for those interested in speed and convenience, but useful if assembly language is extensively used.

There will be a large range of new software from Apple in 1981. It is called Special Delivery Software and is Apple Inc.'s selection from the thousands of programs Apple programmers have sent to headquarters. The release of Neil Bennets' Handholding Basic is also imminent.

Electronic Concepts has decided to push Apples in 1981 with an extensive dealer and OEM network with rumours of new Computerland stores in Chatswood, Parramatta, Newcastle, Canberra and Hobart. The Sydney Computerland is moving down to the corner of York and Market Streets.

Well known NSW AUG member, George Thaminjis, has been employed by Electronic Concepts to establish the Apple HOTLINE. If you have any Apple problems or want to know anything about Apples in Australia, ring the Apple HOTLINE: (02) 929-2422.

Program of the month would have to be Bill Budge's 3D Graphics Database. The program has a simple and effective Editor that accepts a set of points and lines as a shape(s) definition and a ten line Applesoft interface for your program. The shape definition and Budge's display routines are loaded by your program then the shape is rotated, scaled or moved by passing parameters through Integer arrays. Hires page switching is used to produce very fast and smooth animation. The only problems with the package are that the shape is not clipped when it extends off the screen causing wrap around and a nagging suspicion that there may be tiny bugs in the database display routines. Anyone who uses Apples to teach kids programming should have this superb 3D program.

DOS PATCHES

A few quick DOS patches from the S.F. Apple core. If you have a 32k Apple, subtract 4000Hex from each address. Enter the monitor with CALL—151 then make these changes.

1. Fast disk INIT

```
DOS3.2   BEAD:28 BF62:07 BFAC:EA  EA
DOS3.2.1 BEB1:28 BF66:07 BFAE:EA  EA
```

Now INIT a disk.

2. To use a binary HELLO program 9E42:34

3. Free sectors with CATALOG

```
BCBA:  A2   0C   20   4A   F9   A9   00 85
       40   85   41   A0   C8   18   B9 F2
       B3   F0   0E   0A   90   FB   48 E6
       40   D0   02   E6   41   68   18 90
       F0   88   D0   E9   A6   40   A5 41
Integer   Basic    BCE2:  20      1B E5
A'soft    Basic    BCE2:  20      24 ED
BCE5:  20   2F   AE    60
ADC3:  20   BA   BC
```

All of the above patches can be saved by INITialising a disk with the patched DOS. The next patch must be POKEd after DOS has been booted.

4. Abort CATALOG during screen full pause by pressing 'ESC'.

```
AE39:  20   80   B6
B680:  20   0C   FD C9 9B D0 03 4C
       D0   03   60
```

5. The start address and length of a binary file can be found at
AA60/AA61 — Length
AA72/AA73 — Start Address
after a BLOAD of the file.

NOT DESIGNED FOR MUSIC

THE TROUBLE WITH TRS-80's

We like Tandy's home computer. At 16K Level II stage it is a reliable and reasonably priced entry to the magic of computers. But that cassette!

Tandy's optional "glitch kit" makes it fairly dependable, but it's still slow, requires knob twiddling for volume level and button pushing for operation.

Enough to put you off computers!

TANDY's ANSWER

Of course Tandy has an answer, add an expansion interface and a small disk drive.

Ask the price!

ASP's ANSWER

Now we have an alternative, and its not just a matter of offering a non-standard small disk drive a little cheaper than Tandy with the attendant risk if it doesn't work.

STRINGY FLOPPY

The solution is a compact high-speed tape transport system entirely under the control of the computer - designed for data - not music. Its called STRINGY FLOPPY

There are no controls to fiddle with, just one light indicating the drive is in operation and another indicating that data is being written onto wafer. It simply plugs into the back of the Tandy keyboard unit. Or with an optional adaptor into the System 80 Computer sold by Dick Smith.

WAFERS - NOT CASSETTES

Unlike the cassette recorder that comes with the Tandy, STRINGY FLOPPY uses specially designed "wafers" about the size of a credit card and 5 mm. thick. These contain an endless loop of special chromium dioxide tape ranging in length from 1.6 to 23 metres. Their low mass means they operate reliably at high speed.

Removal of a reflective label protects them against accidental overwriting of data.

Their special tape and the digital recording method used means you don't lose data.

RELIABLE RECORDING

STRINGY FLOPPY uses a true digital recording technique like floppy disks, not fluctuating audio tone. The result - RELIABILITY.

The system was designed for computers - not designed for music.

NO MAINTENANCE DRIVE UNIT

The STRINGY FLOPPY wafer has the pressure roller for the capstan built in. So the capstan and the record head can be fixed in the die-cast aluminium drive. No adjustments required. The wafer just slides into the drive and "clicks" home. No other mechanical motion is required. And because wafers contain endless loops, the tape always travels in the same direction.

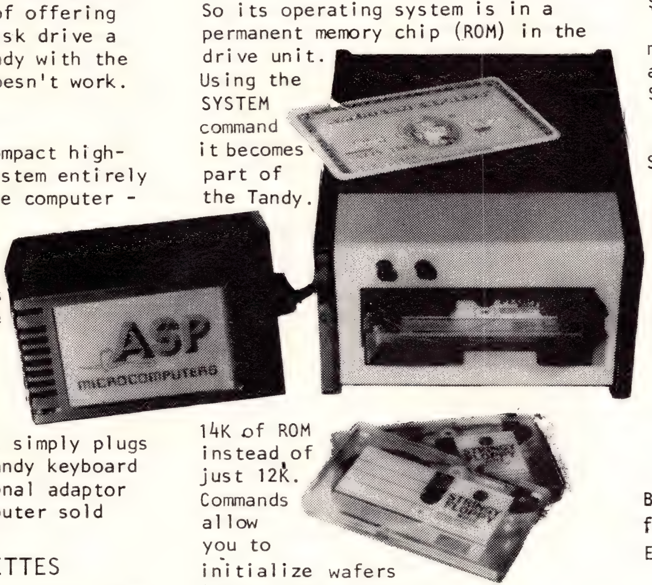
There is no need for a rewind capability.

Simplicity means reliability.

INTEGRATION TO THE TANDY

All this would be useless if STRINGY FLOPPY wasn't easy to use. So its operating system is in a permanent memory chip (ROM) in the drive unit. Using the SYSTEM command it becomes part of the Tandy. 14K of ROM instead of just 12K. Commands allow you to initialize wafers (prove their integrity), load or save up to 99 files on a wafer on up to 8 STRINGY FLOPPY drives connected to the Tandy.

Programs can be in BASIC or machine language. Loading the 1K DATA I/O program from wafer adds additional commands to store and retrieve data rather than programs.



SPECIAL BONUS

Those who know their Tandy's well will know all about the dreaded keybounce! Well, STRINGY FLOPPY's ROM contains a keybounce fix routine.

Nice?

RECORDING SPEED DENSITY

STRINGY FLOPPY records at 7200 baud (700 characters per second), 14 times faster than Tandy's cassette on a Level II machine. Tape speed is 25 cms. per second, so you can calculate access and loading times. If you "hot-up" your Tandy by increasing the clock speed you will get a proportionate increase in data density and therefore wafer capacity.

Even on a standard Tandy you can fit up to 64K on a 23 metre wafer.

PROGRAMMING

With STRINGY FLOPPY you can create programs which chain under the control of your computer. The pressure on memory diminishes. ASP has programs such as its word processor and a data base manager which can demonstrate the possibilities for clever creative programming.

THE CATCH

OK, the bottom line. STRINGY FLOPPY complete with operating system, plug pack power supply, DATA I/O program is $350.00 including Sales Tax. Add $5.00 for freight within Australia.

And we'll include a box of 10 mixed length wafers (normally $35.00) and a 2 for 1 bus extender (normally $20.00) in the price.

And a six month limited warranty.

And a year's subscription to our STRINGY FLOPPY Newsletter.

AND if you're not satisfied with STRINGY FLOPPY, return it within two weeks for a courteous refund (this applies only to non-Bankcard purchases).

So maybe there wasn't a catch.

BANKCARD orders must quote full Bankcard number, Expiry Date and be signed.

Versions for other computers are available.

ASP
MICROCOMPUTERS

797 DANDENONG ROAD,
EAST MALVERN 3145.
VICTORIA AUSTRALIA.
Telephone: 211 8855 211 8344

Continued from page 27

facilitiate this kind of programming. UCSD has had to define an extra data type the STRING (= PACKED ARRAY [1 .. 80] OF CHAR) so that the function calling (and returning) mechanism will work. Since we are concerned in this series merely with using PASCAL compilers and not writing them, we must be content with a more pedestrian set of procedures.

In particular we have had to write procedures instead of UCSD string functions and our string handling functions and procedures cannot cope with literal strings (e.g. LENGTH ('HI THERE') will cause a compiling error.

The UCSD string functions and procedures are as follows:

1 FUNCTION LENGTH (STRING): INTEGER returns the number of characters in the string STRING.

2 FUNCTIONS POS(STRING, SOURCE): INTEGER
returns the position of substring in string SOURCE.

If more than one occurrence exists, POS will return the first. If no occurrence exists, POS will return 0.

3 FUNCTION CONCAT (SOURCE1, SOURCE2, . .): STRING
returns a string which is the concatenation of the set of strings passed in the parameter list taken in order. Note the replacement version in Box 8 is a procedure rather than a function and only concatenates a pair of strings.

4 FUNCTION COPY (SOURCE, INDEX,SIZE) : STRING
returns a string containing the substring of length size starting at position INDEX in STRING.

5 PROCEDURE DELETE (DESTINATION,INDEX,SIZE)
deletes SIZE characters from the string DESTINATION starting at position INDEX.

6 PROCEDURE INSERT(SOURCE, DESTINATION,INDEX)
inserts substring SOURCE into string DESTINATION starting at position INDEX.

In addition, Box 8 contains two procedures to read and write strings (STREAD and STWRITE). This is managed at system level in UCSD PASCAL so READ and WRITE will accept strings as parameters.

Exercise: Write a program to read in a positive integer less than 10,000 and print out the value in words, e.g.:

input 1705
output ONE THOUSAND SEVEN
HUNDRED AND FIVE

Use a function to extract the digits from the number, one at a time starting with the thousands, and a variable parameter to convert the digit into a word. Anything from 10 to 99 will need special treatment, especially up to 19. Use CONCAT to put the output string together.

Conclusion

This chapter has expanded the concepts of the procedure beyond that of a means of modularising programs. Value parameters are passed when there is no requirement to return their values at the end of the called procedure. Functions are used when a single result of a simple data type is required and variable parameters are used for more complicated returns. We concluded with a collection of string handling functions and procedures designed to emulate UCSD's string handling facilities.

Look up table

PASCAL Reserved Words
FUNCTION

Computer Jargon	
Stack	
Push	
Pop	
Actual Parameter	
Formal Parameter	
Value Parameter	Call-by-value
Variable Parameter	Call-by-Name
Side-Effect	

UCSD Exceptions
STRING = Standard type

Section 4 details implications and standard functions available

Have a peek....

Just a selection of books available from Australia's largest range of computer literature.

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6502 Software Gourmet Guide & Cookbook (Scelbi)	$16.80
6502 Software Design (Scanlon)	$14.25
PET-CBM Personal Computer Guide (Donahue)	$20.50
Programmer's Guide to LISP (Tracton)	$ 7.50
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TRS-80 Disk and Other Mysteries (TRS-80 Information Series — Volume 1) (Pennington)	$19.80
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Reading 'System' tapes into the System 80

by M. Dinn

As supplied, the System 80 can only read 'System' tapes from the on-board recorder. As there is no level control on this recorder, there will inevitably be times when a System tape cannot be loaded due to level or noise variations. The problem can be solved in a number of ways. Dick Smith's Technical Bulletin 12 describes an additional switch to make the off-board recorder (number 2), look like recorder one, and Technical Bulletin 17 describes the addition of a volume control for recorder one. This article describes a software solution, with some valuable additional 'goodies' related to System tape handling.

The program assembly listing is shown below. It has separate entry points for recorders one and two. After turning on the appropriate recorder it reads and displays:

1. File name.
2. First address.
3. Incrementing address of data being stored, terminating in the last address.
4. Usual flashing asterisks.
5. Entry address in hex and decimal.

It then turns off the recorder and jumps to the normal system cue (?*), ready for execution.

If a checksum error is found, the values of checksums already calculated are displayed (with an asterisk), and control passes back to the system cue. The incrementing address will indicate the end of the block where the error was found.

The 'goodie' information displayed is very useful, (and necessary) when making back-up copies of System tapes using, say, TBUG or RSM. It allows the loading of tapes where the file name isn't known and the checksum fault address can help in determining whether an error is occurring randomly or at the same place.

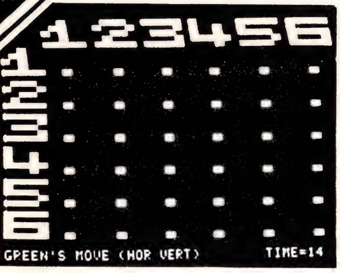
The program occupies only ¼k and, for the sake of maximum available user RAM, should be placed near the top of memory. As described it should be a valuable addition to a System 80 (or TRS-80) library.

```
0000 3E01     00010         LD      A,1      ;CONFIG
0002 323D40   00020         LD      (403DH),A;RECORDER
0005 AF       00030         XOR     A        ;REC 1
0006 1807     00040         JR      REC      ;TO REC SELECT
0008 3E01     00050         LD      A,1      ;CONFIG
000A 323D40   00060         LD      (403DH),A;RECORDER
000D 3E10     00070         LD      A,10H    ;REC 2
000F CD1202   00080 REC     CALL    212H     ;SELECT REC 1 OR 2
0012 CD9602   00090         CALL    0296H    ;GET SYNC
0015 CD3502   00100 BYTE    CALL    0235H    ;READ BYTE
0018 FE55     00110         CP      55H      ;FILE NAME
001A 20F9     00120         JR      NZ,BYTE  ;AGAIN IF NOT
001C 21D03F   00130         LD      HL,3FD0H;NAME WRITE LOC
001F 0606     00140         LD      B,6      ;NAME CHAR COUNTER
0021 CD3502   00150 NAME    CALL    0235H    ;READ NAME BYTE
0024 77       00160         LD      (HL),A   ;TO SCREEN
0025 23       00170         INC     HL       ;INC SCREEN
0026 10F9     00180         DJNZ    NAME     ;6 TIMES
0028 3EFF     00190         LD      A,0FFH   ;'FIRST' FLAG
002A 08       00200         EX      AF,AF'   ;SAVE IN A'
              00210
002B CD2C02   00220 BLOCK   CALL    022CH    ;FLASH *
002E CD3502   00230 ID      CALL    0235H    ;READ BLOCK ID
0031 FE78     00240         CP      78H      ;END?
0033 283C     00250         JR      Z,ENTRY  ;TO ENTRY ADDR IF SO
0035 FE3C     00260         CP      3C       ;DATA BLOCK?
0037 20F5     00270         JR      NZ,ID    ;AGAIN IF NOT
0039 CD3502   00280         CALL    0235H    ;READ BYTES IN BLOCK
003C 47       00290         LD      B,A      ;SAVE IN B
              00300
003D CD1403   00310         CALL    0314H    ;READ BLOCK ADDR
0040 85       00320         ADD     A,L      ;START CKSUM
0041 4F       00330         LD      C,A      ;SAVE CKSUM
0042 08       00340         EX      AF,AF'   ;'FIRST' FLAG
0043 B7       00350         OR      A        ;ZERO?
0044 2807     00360         JR      Z,FLAG   ;JP IF NOT FIRST
0046 11D83F   00370         LD      DE,3FD8H;FIRST BLOCK WRITE LOC
0049 CD8E00   00380         CALL    HLWR     ;WRITE FIRST BLOCK ADDR
004C AF       00390         XOR     A        ;CLEAR 'FIRST' FLAG
004D 08       00400 FLAG    EX      AF,AF'   ;RE-SAVE FLAG IN A'
              00410
004E CD3502   00420 DATA    CALL    0235H    ;READ DATA BYTE
0051 11E03F   00430         LD      DE,3FE0H;WRITE LOC
0054 CD8E00   00440         CALL    HLWR     ;WRITE DATA ADDR
0057 77       00450         LD      (HL),A   ;DATA TO STORE
0058 23       00460         INC     HL       ;INC STORE POINTER
0059 81       00470         ADD     A,C      ;ADD CKSUM TO DATA
005A 4F       00480         LD      C,A      ;RE-SAVE CKSUM IN C
005B 10F1     00490         DJNZ    DATA     ;DO 'NO. BYTES' TIMES
              00500
005D CD3502   00510         CALL    0235H    ;READ CKSUM
0060 B9       00520         CP      C        ;COMPARE WITH CALC
0061 28C8     00530         JR      Z,BLOCK  ;NEXT BLOCK IF OK
              00540
0063 67       00550         LD      H,A      ;ELSE READ TO H
0064 69       00560         LD      L,C      ;AND CALC TO L
0065 11F03F   00570         LD      DE,3FF0H;CKSUMS WRITE LOC
0068 CD8E00   00580         CALL    HLWR     ;WRITE CKSUMS
              00590
006B AF       00600         XOR     A        ;CLEAR A
006C D3FE     00610         OUT     (0FEH),A;TURN OFF REC
006E C3AC02   00620         JP      02ACH    ;TO 'SYSTEM' CUE
              00630

0071 CD1403   00640 ENTRY   CALL    0314H    ;READ ENTRY ADDR
0074 11E83F   00650         LD      DE,3FE8H;WRITE LOC
0077 CD8E00   00660         CALL    HLWR     ;WRITE ENTRY ADDR
007A E5       00670         PUSH    HL       ;SAVE ENTRY HEX
007B CDB900   00680         CALL    HEXDEC   ;ENTRY HEX TO DEC
007E 11F03F   00690         LD      DE,3FF0H;WRITE LOC
0081 CDAA00   00700         CALL    CHAR     ;WRITE FIRST DEC NO.
0084 CD8E00   00710         CALL    HLWR     ;WRITE OTHER DIGITS
0087 E1       00720         POP     HL       ;RESTORE ENTRY HEX
0088 AF       00730         XOR     A        ;CLEAR A
0089 D3FE     00740         OUT     (0FEH),A;TURN OFF REC
008B C3AC02   00750         JP      02ACH    ;TO 'SYSTEM' CUE
              00760    ;SUB TO WRITE HL TO SCREEN
              00770
008E F5       00780 HLWR    PUSH    AF       ;SAVE REGS
008F C5       00790         PUSH    BC       ;SAVE REGS
0090 7C       00791         LD      A,H      ;FIRST PAIR IN A,C
0091 4F       00792         LD      C,A      ;
0092 CD9E00   00800         CALL    PAIR     ;WRITE H
0095 7D       00810         LD      A,L      ;2ND PAIR IN A,C
0096 4F       00820         LD      C,A      ;
0097 CD9E00   00830         CALL    PAIR     ;WRITE L
009A 13       00840         INC     DE       ;INC SCREEN
009B C1       00850         POP     BC       ;RESTORE REGS
009C F1       00860         POP     AF       ;RESTORE REGS
009D C9       00870         RET              ;SUB END
              00880    ;SUB TO WRITE PAIR OF CHARS
009E 0F       00890 PAIR    RRCA             ;HI TO LO NIBBLE
009F 0F       00900         RRCA             ;
00A0 0F       00910         RRCA             ;
00A1 0F       00920         RRCA             ;
00A2 CDAA00   00930         CALL    CHAR     ;WRITE HI DIGIT
00A5 79       00940         LD      A,C      ;
00A6 CDAA00   00950         CALL    CHAR     ;WRITE LO DIGIT
00A9 C9       00960         RET              ;END SUB
              00970    ;SUB TO WRITE A CHAR
00AA CDB000   00980 CHAR    CALL    ASCII    ;GET ASCII OF A
00AD 12       00990         LD      (DE),A   ;WRITE TO SCREEN
00AE 13       01000         INC     DE       ;INC SCREEN
00AF C9       01010         RET              ;END SUB
              01020    ;SUB FOR ASCII OF A REG
00B0 E60F     01030 ASCII   AND     0FH      ;MASK OUT HI NIBB
00B2 C690     01040         ADD     A,90H    ;ADD 90
00B4 27       01050         DAA              ;
00B5 CE40     01060         ADC     A,40H    ;ADD 40 W CY
00B7 27       01070         DAA              ;
00B8 C9       01080         RET              ;END SUB
              01090    ;SUB FOR HEX TO DECIMAL IN HL,
              01100    ;TOP DIGIT BACK IN A
00B9 C5       01110 HEXDEC  PUSH    BC       ;SAVE REGS
00BA D5       01120         PUSH    DE       ;SAVE REGS
00BB EB       01130         EX      DE,HL    ;HL TO DE
00BC AF       01140         XOR     A        ;CLEAR ANY CY
00BD ED62     01150         SBC     HL,HL    ;CLEAR HL
00BF 010010   01160         LD      BC,1000H;B=10,C=0
              01170
00C2 AF       01180 LOOP    XOR     A        ;CLEAR CY
00C3 CB13     01190         RL      E        ;)SHIFT HIGHEST
00C5 CB12     01200         RL      D        ;)BIT INTO CY
00C7 7D       01210         LD      A,L      ;
00C8 8F       01220         ADC     A,A      ;DOUBLE 'L' WITH CY
00C9 27       01230         DAA              ;DEC ADJUST
00CA 6F       01240         LD      L,A      ;
```

APPLE II

Brain Games-1, CS-4004 (16K)



```
123456
GREEN'S MOVE (HOR VERT)   TIME=14
```

1. Nuclear Reaction

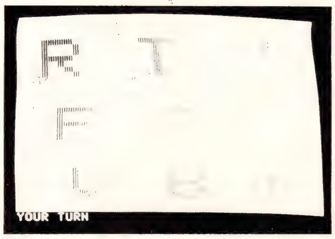
Nuclear Reaction is an exciting strategy game for two players. Each player, in turn, places a particle of radioactive material on a 6x6 board. When the number of particles at a location reaches its critical mass, it explodes, sending a particle to adjacent squares. As the board fills up, a single explosion can cause long chain reactions. The object of the game is to cause the right chain reaction to wipe out all your opponent's pieces. Nuclear Reaction is a game of skill, fast decisions, and quick reversals, making it fun to play for many hours. Action sound effects.

2. Dodgem

In Dodgem, two sets of pieces move at right angles across a checker style board. The object is to move all your pieces across the board and off the opposite edge. One player moves from the bottom to the top while the other moves left to right. You may play Dodgem against the APPLE or a friend. Six board sizes and action sound effects.

3. Dueling Digits

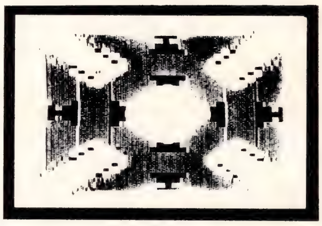
Do you have a good memory for sequences of numbers? Play Dueling Digits and find out. In this game, the computer presents a digit and tone, then erases it. You then type in the same digit. After each turn, the computer repeats all the previous digits and adds a new one, and you try to type in the entire sequence. The round is over when you make four mistakes. For up to four players. Two skill levels.



```
YOUR TURN
```

4. Parrot

Parrot is similar to Dueling Digits, but you try to remember sequences of letters and tones instead. Two skill levels.



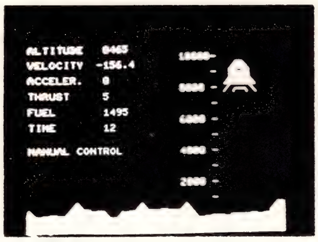
5. Midpoints and Lines

These two colorful graphics demonstrations will run continuously. Great for store displays, parties, and showing off your computer.

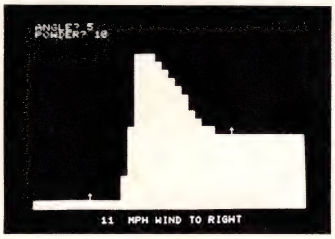
6. Tones

This program allows you to make your own music and sound effects with the game paddles. One paddle controls the pitch of the tone, the other controls the duration. No special hardware is required.

Sorcerer
Graphics Games-2, CS-5001 (8K)



```
ALTITUDE  0465
VELOCITY  -156.4
ACCELER.  0
THRUST    5
FUEL      1495
TIME      12
MANUAL CONTROL
10000
8000
6000
4000
2000
```



```
ANGLE? 5
POWDER? 10
11 MPH WIND TO RIGHT
```

1. LEM

In this graphic version of the popular real time lunar landing game you must land on the moon's surface with the lowest possible velocity. You can control the thrust of your retro-rockets with the number keys but you have a limited amount of fuel. The automatic pilot option can be activated and deactivated with the keyboard. You take a walk on the moon and plant a flag if you land successfully.

2. Pie Lob

This is a game in which two players lob pies at each other across a computer-generated hill. You choose the angle and the strength of the throw and then watch the trajectory of the lob across the screen. The computer changes the terrain and the wind speed in each game. Pie Lob makes good use of SORCERER's graphics.

3. Nuclear Reaction

Nuclear Reaction is an exciting strategy games for two players. Each player, in turn, places a particle of radioactive material on a 6x6 board. When the number of particles at a location reaches its critical mass, it explodes, sending particles to adjacent squares. As the board fills up, a single explosion can cause long chain reactions. The object of the game is to cause the right chain reactions to wipe out all your opponent's pieces. Nuclear Reaction is a game of skill, fast decisions, and quick reversals, making it fun to play for many hours.

4. Bounce

Bounce is an intriguing graphics demonstration which traces the path of a ball as it bounces around the screen.

5. Checkers

The SORCERER matches its strategy against yours in this popular game. The computer does not look more than one move ahead, hence the game is best suited for beginning players.

6. Dodgem

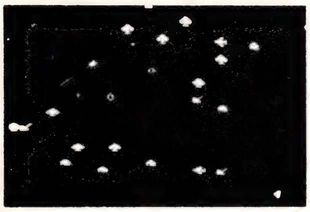
Dodgem is played on a checker-type board against the computer or another player. The object of the game is to block your opponent to slow him down. One player moves pieces from the bottom of the board to the top, and the other player moves from left to right, trying to get all the pieces off the board. This is a challenging game of strategy.

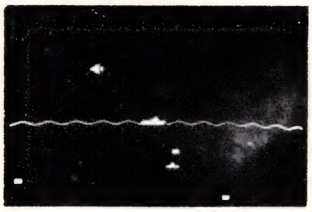
CHALLENGER

Graphics Games-3,
CS-6001 (8K)

1. Tank Attack

Maneuver your tank around trees, houses and airplanes to destroy enemy guns. The guns fire back, and sometimes you get the distinct impression you have been lulled into a sense of security before getting blown up. A challenging real time game written by one of our most vicious programmers.





2. Dodgem

Dodgem is played on a checker-type board against the computer or another player. The object of the game is to block your opponent to slow him down. One player moves pieces from the bottom of the board to the top, and the other player moves from left to right, trying to get all the pieces off the board. A challenging strategy game.

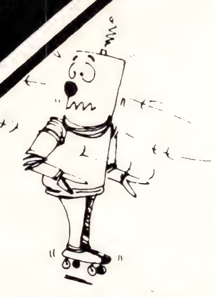
3. Free For All

This game started as a joke, but it's for real! Two people compete against each other and the computer. A submarine, a destroyer, and a plane, criss cross the screen. Each may fire at the others. Free For All makes extensive uses of the Challenger's graphics.

4. Hidden Maze

In this game, two players (you, and the computer or a friend) compete to be the first to reach the opposite side of the maze. The maze is hidden at first and is only revealed as you run into parts of it. Swinging gates add an additional challenge to this game of memory and skill

RS-80
LEVEL II



Pursuit Games, CS-3004 (16K)

- **Stock Car Race**

Stock Car Race is a real time racing game on a road race circuit. Your high speed racer is controlled by the "arrow" keys, as you shift up and down through four gears. Take the turns slowly, "floor it" on the straights, but don't blow your engine!

- **Maze**

Maze for the Level II 16K machine is a high speed pursuit game. You are timed throughout your run and rated on the basis of elapsed time and the number of moves required to escape. A different maze every time. Nine skill levels.

- **Indy Racer**

Indy Racer is a real time racing game for the TRS-80. You're in the driver's seat of a red-hot Indy car, changing gears and weaving around the track as you pass your competitors. Indy Racer is similar to the popular arcade-style driving games.

- **Depth Charge**

As commander of a destroyer, your mission is to destroy as many enemy subs as possible. Move your ship back and forth on the water, positioning yourself over enemy subs as they cruise into range. Depth charges sink slowly, so timing and position are important in this re-creation of the Battle of the Atlantic.

- **Kaleidoscope**

This graphics demonstration program turns your TRS-80 into a computer age kaleidoscope. You enter the number of lines and size of the display to produce changing patterns on the video monitor. Truly hypnotizing, Kaleidoscope runs continuously to brighten up your home or office.

WRITE FOR...
FREE
SOFTWARE CATALOG

Strategy Games, CS-3005 (16K)

- **Tunnel Vision**

You are transported into a massive labyrinth and must find the exit or be lost forever. This is an excellent example of three dimensional perspective using TRS-80 graphics.

- **Evasion**

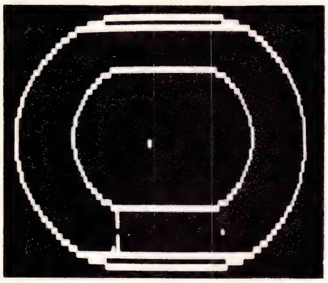
In this real time game, you are pursued around the game board by an evil-looking snake. Variations of play include two different speeds and hyper-jumps which randomly relocate you on the board. Looking for an escape? Try Evasion.

- **Jigsaw**

Jigsaw is a computer-age puzzle game making extensive use of TRS-80 graphics. The computer generates a random puzzle and puzzle board. Using a combination of deductive reasoning and luck you must fit the graphically represented puzzle piece into place.

- **The Masters**

Are you a wandering pro or just a Sunday golfer who would like to keep in practice? Once you're on the green, a worm's-eye view is displayed for putting.



- **Motor Racing**

Motor Racing combines real time racing action with advanced graphics functions. The graphics and animation make Motor Racing fun to watch as well as play.

Space Games-3, CS-3002 (16K)

- **Ultra-Trek**

Ultra-Trek is a fast-paced version of Star Trek, complete with "real time" action graphics, lasers, Nilon space mines, high energy photon torpedoes, enemy ships that move, and an experimental ray which does something different each time you use it. You must act quickly to save yourself and the Federation.

- **Star Lanes**

Imagine yourself the president of an intergalactic shipping company. If you're successful, you may be named Imperial Advisor on Economic Affairs. Entrepreneurs: to your ships.

- **Star Wars**

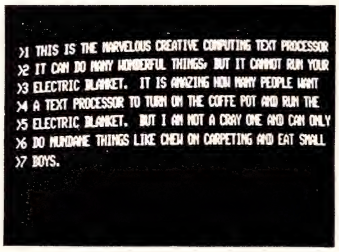
If you hate Darth Vader, you'll love Star Wars. This real time game is fun for aliens of all ages. May the Force be with you!

- **Romulan**

Your mission is to destroy an invading Romulan space craft. Maneuver through space and around stars looking for the deadly enemy, but be careful! The nasty Romulans fire back.

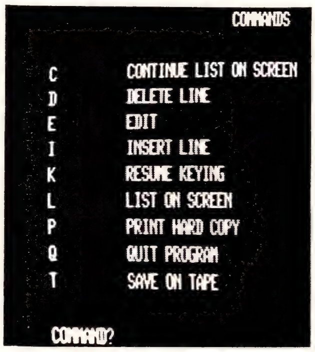
Text Processing, CS-3302 (16K)

This program turns a 16K, TRS-80 and lineprinter into a line oriented text-processing system.



```
>1 THIS IS THE MARVELOUS CREATIVE COMPUTING TEXT PROCESSOR
>2 IT CAN DO MANY WONDERFUL THINGS, BUT IT CANNOT RUN YOUR
>3 ELECTRIC BLANKET.  IT IS AMAZING HOW MANY PEOPLE WANT
>4 A TEXT PROCESSOR TO TURN ON THE COFFE POT AND RUN THE
>5 ELECTRIC BLANKET.  BUT I AM NOT A CRAY ONE AND CAN ONLY
>6 DO MUNDANE THINGS LIKE CHEW ON CARPETING AND EAT SMALL
>7 BOYS.
```

Developed exclusively for the TRS-80, this program lets you use the computer to enter general text or business letters, edit and modify your work, save text on cassette tapes, and print out a perfect report, document, or letter every time.



```
                         COMMANDS

 C        CONTINUE LIST ON SCREEN
 D        DELETE LINE
 E        EDIT
 I        INSERT LINE
 K        RESUME KEYING
 L        LIST ON SCREEN
 P        PRINT HARD COPY
 Q        QUIT PROGRAM
 T        SAVE ON TAPE

  COMMAND?
```

Editing commands are similar to those used in Level II BASIC, so there are no complicated new commands to learn. Lines may be either inserted or deleted. A special format is available to speed entry of business letters. Final printout can be done in numbered pages and you may print multiple copies.

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PROGRAMS

```
00CB 7C        01250         LD     A,H     ;
00CC 8F        01260         ADC    A,A     ;DOUBLE 'H' WITH CY
00CD 27        01270         DAA            ;DEC ADJUST
00CE 67        01280         LD     H,A     ;
00CF 79        01290         LD     A,C     ;
00D0 8F        01300         ADC    A,A     ;DOUBLE 'C' WITH CY
00D1 4F        01310         LD     C,A     ;
00D2 10EE      01320         DJNZ   LOOP    ;DO 10H TIMES
               01330
00D4 79        01340         LD     A,C     ;TOP DIGIT TO A
00D5 D1        01350         POP    DE      ;RESTORE REGS
00D6 C1        01360         POP    BC      ;RESTORE REGS
00D7 C9        01370         RET            ;SUB END
0000           01380         END
```

Monster multiplier

by Alan Thomas

This program written for an Apple II, provides accurate answers to multiplications such as —

3476190752188765349126 x
3144989263874485.

The structure of the program is based on the Trachtenberg Speed System for multiplication, whereby each digit of the answer is calculated by cross multiplications and mental additions.

Input numbers should not exceed 239 digits in length, while the product can have no more than 254 digits.

```
 10  REM 'MONSTER MULTIPLIER'
 20  GOTO 50
 30  FOR H = 1 TO Y:M(Z) = M(Z) +
      N(H): NEXT :M(Z) = M(Z) + C%
      :C% = M(Z) / 10:D = M(Z) - C
      % * 10:C$ =  STR$ (D) + C$
 40  VTAB V: HTAB L + 1 - S: PRINT
      D;:S = S + 1: RETURN
 50  TEXT : HOME :N = 255: DIM A(N
      ),B(N),M(N),N(N)
 60  PRINT "ENTER FIRST INTEGER": PRINT
      : INPUT A$: PRINT
 70  PRINT "ENTER SECOND INTEGER":
       PRINT : INPUT B$: HOME : PRINT
      A$: PRINT "*": PRINT B$: PRINT
      "=":C% = 0:S = 0:C$ = "":V =
       PEEK (37) + 1
 80  IF  LEN (A$) <  LEN (B$) THEN
      Z$ = A$:A$ = B$:B$ = Z$
 90 A =  LEN (A$):B =  LEN (B$):L =
      A + B - 1:P = B + 1:Q = A -
      B:R = P:X = B
100  FOR J = 1 TO A:A(J) =  VAL (
      MID$ (A$,J,1)): NEXT : FOR
      J = 1 TO B:B(J) =  VAL ( MID$
      (B$,J,1)): NEXT
110  FOR J = B TO 1 STEP  - 1: FOR
      K = B TO J STEP  - 1:N(P - K
      ) = A(Q + K) * B(B + J - K):
      NEXT :Y = P - J:Z = Y: GOSUB
      30: NEXT
120  IF Q = 0 THEN R = B:X = B -
      1: GOTO 150
130  IF Q = 1 GOTO 150
140  FOR J = 1 TO Q - 1: FOR K =
      B TO 1 STEP  - 1:N(P - K) =
      A(Q + K - J) * B(P - K): NEXT
      :Y = B:Z = B + J: GOSUB 30: NEXT

150  IF X = 0 GOTO 170
160  FOR J = 1 TO X: FOR K = X TO
      J STEP  - 1:N(R - K) = A(1 +
      K - J) * B(R - K): NEXT :Y =
      1 + X - J:Z = L + J - X: GOSUB
      30: NEXT
170  FOR Z = 1 TO L:M(Z) = 0: NEXT

180  IF C% > 0 THEN D = C%:C$ =  STR$
      (D) + C$: GOSUB 40
190  VTAB 21: HTAB 13: PRINT "CON
      TINUE (Y/N) ";: GET YN$
200  IF YN$ = "N" THEN  END
210 A$ = C$: HOME : PRINT A$: PRINT
      : GOTO 70
220  REM MAX  INPUT = 239 DIGITS
230  REM MAX ANSWER = 254 DIGITS
240  REM ALAN THOMAS:15 DEC,1979
```

LEISURE LINES

With J.J. Clessa

The problem set in November Leisure Lines was to find the smallest square that is also the average of two other perfect squares. Despite being rather easy, more than 10 of the 50-odd entries received turned out to be incorrect.

Clearly there is an infinite number of squares which satisfy the conditions, but the smallest of these is 25, which is the average of 1 and 49. So, this month's prize of an enormous beachtowel goes to the first correct entry selected — which was from Mr. P.Cogar of Narrabeen, N.S.W.

Many thanks, by the way, to those of you who have sent in ideas for future puzzles. They're always welcome and I'll undoubtedly be using some of them in future issues.

QUICKIE

This one shouldn't cause too many brain ruptures! As usual, no prizes and no answers.

A girl has as many sisters as she has brothers. But each brother has twice as many sisters as brothers. How many brothers and sisters in the family?

PRIZE PUZZLE

A nice variation on the "truth/lie situation"!

There is a famous island in the Pacific (whose name I forget) on which there live three tribes:

— the Whites, who always tell the truth
— the Blacks, who always tell lies
— the Greys, who lie and tell the truth alternately . . .
(although their first answer may be either truth or lie).

These natives always gather in groups of three, with one representative from each tribe in the group. A visitor to the island approached such a group of three natives and had the following conversation with the first native.

"Are you the White, the Black, or the Grey?"
"I am the Grey."
"And what about your first friend here?"
"He is a Black."
"So your other friend is the White?"
"Of course."

Was the "Other friend" a White — and if not, what was he?

Answers please on a *postcard* to Puzzle No. 8, Australian Personal Computer, P.O. Box 115, Carlton, 3053. All solutions must arrive by February 27th at the latest.

PRIZE OF THE MONTH

For connoisseur drunks only, this month I'm giving away a bottle of Remy Martin champagne cognac (which I may be bringing around to deliver personally). As usual, good luck (hic!).

Australia's first under $300 COMPUTER...

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Two unique and valuable components of the Sinclair ZX80: the Sinclair BASIC interpreter and the Sinclair teach-yourself BASIC manual. **The unique Sinclair BASIC interpreter:** offers remarkable programming advantages — unique 'one touch' key word entry. The ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST etc) have their own single key entry. Unique syntax check. Only lines with correct syntax are accepted into programs. A cursor identifies errors immediately, preventing entry of long and complicated programs with faults only to discover them when you run.

Excellent string handling capability — takes up to 26 string variables of any length. All strings can undergo all rational tests (e.g. comparison). The ZX80 also has string input to request a line of text; strings do **not** need to be dimensioned. Up to 26 single dimension arrays. FOR/NEXT loops nested up to 26. **Variable names** of any length. BASIC language also handles full Boolean arithmatic, conditional expressions, etc.

Exceptionally powerful edit facilities, allows modification of existing program lines. **Randomise function,** useful for games and secret codes. **Timer under program control.** PEEK and POKE enable entry of machine code instructions. USR causes jump to a user's machine language sub-routine. **High resolution graphics** with 22 standard graphic symbols. **The Sinclair teach-yourself-BASIC manual** 96 page book **free**, with every kit.

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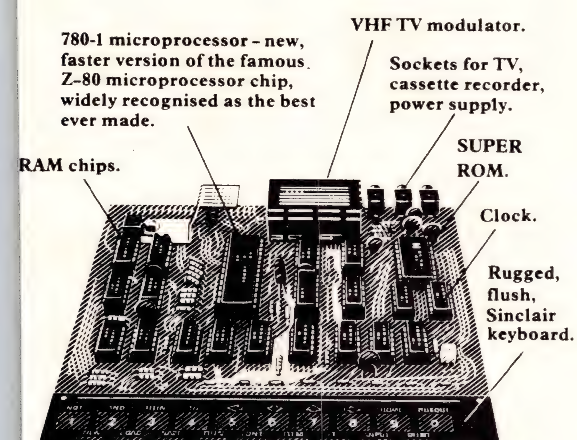
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Read·write routines

Thomas Turnbull presents a method for reading and writing PET data files without error.

This method gives close to 100% reliability. It involves two subroutines to increase the gap between data blocks written to tape, thus allowing the machine to read back all the data without dropping a single block. Remember, if a block that is lost contains an EOT or EOF the computer will crash with hardly any hope of recovery.

My subroutine starts at line 5000 for tape 1 and line 6000 for tape 2. These subroutines need only be used on PRINT files (not READ files). Before opening a print file to CASSETTE 1 have the following POKE commands:

```
10 POKE 244,2:POKE 243,122:open 1,1,1
```

This is the POKE command for CASSETTE 2:

```
20 POKE 244,3:POKE 243,58:OPEN 3,2,1.
```

These POKE commands tell the PET which buffer it is to use and make sure that a proper tape header is written. If this is not done you will be unable to open that file for read operations. These POKE commands need only be put before the open statements and nowhere else in the print file used.

To use these subroutines you must GOSUB 5000 for tape 1 or GOSUB 6000 for tape 2 after every print to the file.

```
40 PRINT*1,A$:GOSUB5000:REM THIS IS FOR TAPE 1

         TAPE 1
5000     IF PEEK(625)<180 THEN RETURN:REM LOCATION
         625 IS THE TAPE 1 BUFFER COUNTER
5010     POKE59411,53:T=TI:REM POKEING LOCATION
         59411 WITH 53 STARTS TAPE 1 MOTOR RUNNING
5020     IF TI-T<6 THEN 5020:REM THIS SETS TAPE
         RUNNING FOR 1/10TH SECOND INCREASING GAP
5030     POKE59411,61:RETURN:REM THIS POKE COMMAND
         SWITCHES CASSETTE 1 OFF

         TAPE 2
6000     IF PEEK(626)<180 THEN RETURN:REM LOCATION
         626 IS BUFFER FOR TAPE 2
6010     POKE 59456,207:T=TI:REM THIS STARTS CASSETTE
         2 MOTOR
6030     IF TI-T<6 THEN 6030
6040     POKE 59456,223:RETURN
```

All PETSOFT programs that use files have this subroutine included and they are very reliable in use.

The reason that the buffer is made to check the number 180, and not 191 as you would expect, is because this keeps the motor running in small starts until the buffer is finally emptied. Once empty, there is no need for the tape recorder to build up to writing speed as it will already be at the right speed and the data will be written at the correct rate.

Program formatter

If your system permits you to save your programs in ASCII format so that they are available as data files to other programs then this routine will permit you to produce a printout of your program that is much more readable than the usual format.

The program does three things:

REM statements are separated by blank lines
FOR — NEXT loops are indented
Line numbers are right justified.

Lines 40 to 80 find the name of the file and open it. Lines 9000 to 9030 deal with the problem of the file not being found. These two sections might have to be rewritten for different Basics.

Additional formatting could be written at line 1250. Possible extensions are:

A blank line after each RETURN
Line number and REM stripped off each remark
Multiple statement lines broken down.

```
 10 REM FORMT  REFORMAT BASIC
    PROGS TO IMPROVE LAYOUT
 20 DEFINT A-Z
 30 INPUT "INPUT FILE NAME = ",F$
 40 F$ =  F$+".BAS"
 50 ON ERROR GOTO 9000
 60 OPEN "I",#1,F$
 80 LINE INPUT #1,I$
 90 GOSUB 1000
100 IF EOF(1) THEN GOTO 200
110 GOTO 80
200 CLOSE
201 STOP
```

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ZX80 Winner

The staff at APC wish to thank the large number of readers who responded to our Readers Survey. The enthusiasm conveyed by our readers was very encouraging, and constructive criticism will play an important role in the future directions of APC.

Definite trends emerged with respect to the type of articles readers would like to see. One of the most popular requests was for a series on assembly and machine languages. So, next month we'll publish the first of a new series entitled "Behind Basic" which goes further than just assembly language to explain the operations of interpreters and compilers and the internal architecture of microprocessors.

Julian De Saxe was the lucky man first out of the hat and is now the proud owner of a Sinclair ZX80. Again, our thanks to Sinclair Equipment for donating the machine.

PROGRAMS

```
1000 FOR I = 1 TO LEN(I$)
1010   K=ASC(MID$(I$,I,1))
1020   IF K <> 32 THEN GOTO 1040
1030   GOTO 1050
1040 NEXT I
1050 K=VAL(LEFT$(I$,I-1))
1060 J$=""
1070 IF K<10000 THEN J$ = J$ + " "
1080 IF K<1000  THEN J$ = J$ + " "
1090 IF K<100   THEN J$ = J$ + " "
1100 IF K<10    THEN J$ = J$ + " "
1110 J$=J$+STR$(K)
1120 FOR J = 1 TO LEN(I$)
1130   IF ASC(MID$(I$,J,1))>57 THEN GOTO 1150
1140 NEXT J
1150 K$=RIGHT$(I$,LEN(I$)-J+1)
1160 IF LEFT$(K$,5) = "NEXT " THEN FORC = FORC - 1
1170 IF FORC < 0 THEN FORC = 0
1180 J$= J$ + STRING$(1+FORC*2,32)
1190 J$= J$+K$
1195 IF LEFT$(K$,4) = "REM " THEN LPRINT
1200 LPRINT J$
1205 IF LEFT$(K$,4) = "REM " THEN LPRINT
1210 IF LEFT$(K$,4) = "FOR " THEN FORC = FORC + 1
1220 FOR I = 4 TO LEN(K$)
1230   IF MID$(K$,I,5)="NEXT " THEN FORC = FORC-1
1240 NEXT I
1250 RETURN
9000 IF ERR<>53 THEN GOTO 9030
9010 PRINT "FILE NOT FOUND"
9015 CLOSE
9020 GOTO 30
9030 ON ERROR GOTO 0
```

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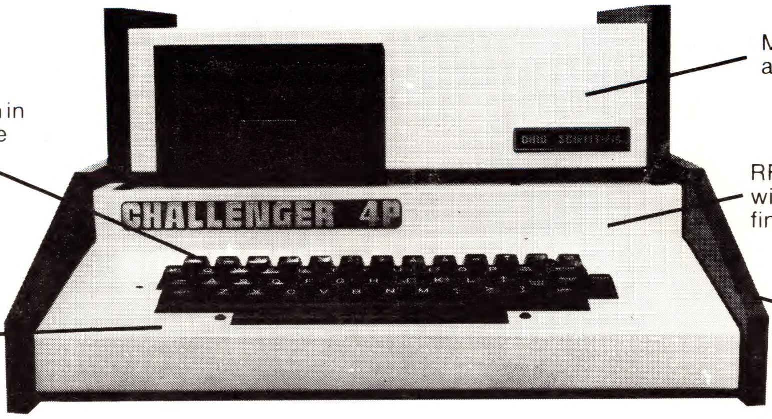

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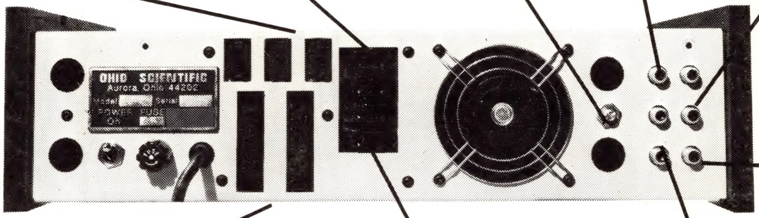

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